CONTRACT DOCUMENTS

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The City of Schertz Standard Specifications and Technical Specifications for construction dated March 2011 or latest edition applicable to this project are to be utilized. These specifications are available from the City of Schertz Public Works Department or from the City of Schertz Web Site.

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GEOTECHNICAL REPORT

SECTION 01145

USE OF PREMISES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. General use of the site including properties inside and outside of rights-of-way, work affecting road, ramps, streets and driveways and notification to adjacent occupants.

1.02 RIGHTS-OF-WAY

A. Confine access, and operations and storage areas to rights-of-way provided by the City as stipulated in General Conditions; trespassing on abutting lands or other lands in the area is not allowed.

B. Make arrangements, at no cost to the City, for temporary use of private properties. Contractor and Surety shall indemnify and hold harmless the City against claims or demands arising from such use of properties outside of rights-of-way. Submit a copy of agreements between private property owners and Contractor prior to use of the area. Agreements between private property owners and Contractor shall be notarized or bear the signatures of two witnesses.

C. Obtain written permission from City of Schertz Parks and Recreation Department for storage of materials on esplanades and other areas within rights-of-way under that department's jurisdiction. Submit copies of written permission prior to use of the area.

D. Restrict total length of distributed materials along the route of construction to 1,000 linear feet unless otherwise approved in writing by Public Works.

1.03 PROPERTIES OUTSIDE OF RIGHTS-OF-WAY

A. Do not alter the condition of properties adjacent to and along rights-of-way.

B. Do not use ways, means, methods, techniques, sequences, or procedures that result in damage to properties or improvements.

C. Restore damaged properties outside of rights-of-ways at no cost to the City.

1.04 USE OF SITE

A. Obtain approvals from governing authorities prior to impeding or closing public roads and streets. Do not close more than two consecutive intersections at one time.

B. Notify Public Works and Emergency Services at least five working days prior to closing a street or street crossing. Obtain permits for street closures in advance.

C. Maintain 10-foot-wide minimum access lanes for emergency vehicles including access to fire hydrants.

D. Avoid obstructing drainage ditches or inlets. When obstruction is unavoidable due to requirements of the Work, provide grading and temporary drainage structures to maintain unimpeded flow.

E. Locate and protect private lawn sprinkler systems that may exist within the site. Repair or replace damaged systems to condition existing at start of the Work, or better.

F. Conform to daily clean-up requirements of Article 5 of General Conditions.

G. Beware of overhead power lines existing in area and in close proximity of the Project. When 10 feet of clearance between energized overhead power line and construction-related activity cannot be maintained, request Power Company de-energize or move conflicting overhead power line. Contact schedule, coordinate, and pay costs associated with de-energizing or moving conflicting overhead power lines. When there is no separate pay item for this effort, include these costs in various items of bid that make such work necessary.

1.05 NOTIFICATION TO ADJACENT OCCUPANTS

A. Notify individual occupants in areas to be effected by the Work of proposed construction and time schedule. Notify not less than 72 hours or more than two weeks prior to work performed within 200 feet of homes or businesses. Follow form and content of sample door hanger provided by Public Works.

B. Include in notification nature of the Work, and names and telephone numbers of two company representatives for resident contact available on 24-hour call.

C. Submit proposed notification to Public Works for approval.

1.06 PUBLIC, TEMPORARY, AND CONSTRUCTION ROADS AND RAMPS

A. Construct and maintain temporary detours, ramps, and roads to provide for normal public traffic flow when it is necessary to close public roads or streets.

B. Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment, large tandem axle trucks or equipment that will damage the existing roadway surfaces.

C. Construct and maintain access roads and parking areas as specified in Section 01504 - Temporary Facilities and Controls.

1.07 EXCAVATION IN STREETS AND DRIVEWAYS

A. Avoid hindering or inconveniencing public travel on streets or intersecting alleys for more than two blocks at any one time, except by permission of Public Works.

B. Obtain Public Works approval when nature of the Work requires closure of an entire street. Permits required for street closure are Contractor's responsibility. Avoid unnecessary inconvenience to abutting property owners.

C. Remove surplus materials and debris and open each block for public use, as work in that block is complete.

D. Acceptance of any portion of the Work will not be based on return of street to public use.

E. Avoid obstructing driveways or entrances to private property.

F Provide temporary crossings or complete excavation and backfill in one continuous operation to minimize duration of obstruction when excavation is required across drives or entrances.

G. Provide barricades and signs in accordance with Section VI of the State of Texas Manual on Uniform Traffic Control Devices.

1.08 TRAFFIC CONTROL

A. Comply with traffic regulation as specified in Section 01555 - Traffic Control and Regulation.

1.09 SURFACE RESTORATION

A. Restore the site to the condition existing before construction, or better.

B. Repair paved areas per the requirements of Section 02951 - Pavement Repair and Resurfacing.

C. Repair damaged turf areas, level with bank run sand conforming to Section 02317 - Excavation and Backfill for Utilities, or topsoil conforming to Section 02911 - Topsoil, and re-sod in accordance with Section 02922 - Sodding. Water and level newly sodded areas with adjoining turf using appropriate steel wheel rollers for sodding. Do not use spot sodding or sprigging.

1.10 LIMITS OF CONSTRUCTION

A. Confine operations to lands within construction work limits shown on Drawings. Unless otherwise noted on Drawings adhere to the following:

1. Where utility alignment is within esplanade, and construction limits are shown on Drawings to extend to edge of esplanade, keep equipment, materials, stockpiles a minimum of five feet from back of curb.

2. Where construction limits shown on Drawings extend to property line, keep sidewalks free of equipment, materials, and stockpiles.

1.11 EQUIPMENT AND MATERIAL SALVAGE

A. Upon completion of the Work, carefully remove salvageable equipment and material. Deliver them to City of Schertz as directed by Public Works. Dispose of equipment offsite at no additional cost to the City when Public Works deems equipment unfit for further use.

PART2 P R O D U C T S - Not Used

PART3 E X E C U T I O N - Not Used

END OF SECTION

SECTION 01255

CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for processing Change Orders, including:

1. Assignment of a responsible individual for approval and communication of change in the Work;

2. Documentation of change in Contract Price and Contract Time;

3. Change procedures, using proposals and Modifications;

4. Execution of Change Orders;

5. Correlation of Contractor submittals.

1.02 REFERENCES

A. Blue Book is defined as the Rental Rate Blue Book for Construction Equipment (a.k.a. Date Quest Blue Book).

B. Rental Rate is defined as the full-unadjusted base rental rate for the appropriate item of construction equipment.

1.03 RESPONSIBLE INDIVIDUAL

A. Provide a letter indicating the name and address of the individual authorized to execute Modifications, and who will be responsible for informing others in Contractor's employ and Subcontractors of changes to the Work. Provide this information at the pre-construction meeting.

1.04 DOCUMENTATION OF CHANGE IN CONTRACT PRICE AND CONTRACT TIME.

A. Maintain detailed records of changes in the Work. Provide full information required for identification and evaluation of proposed changes, and substantiate costs of changes in the Work.

B. Document each proposal for change in the Contract Price or Contract Time with sufficient data to allow evaluation of proposal.

C. Include the following minimum information on proposals:

1. Quantities of items in original Bid Form with additions, reductions, deletions, and substitutions.

2. Quantities and cost of items in original Schedule of Values with additions, reductions, deletions and substitutions.

3. Provide Unit Prices for new items, with supporting information, for inclusion in Schedule of Unit Price Work.

4. Justification for changes in Contract Time.

5. Additional data upon request.

D. For changes in the Work performed on a time-and-material basis, provide the following additional information:

1. Quantities and description of Products.

2. Taxes, insurance and bonds.

3. Overhead and profit as noted in General Conditions.

4. Dates, times and by who work was performed.

5. Time records and certified copies of applicable payrolls.

6. Invoices and receipts for Products, rental equipment, and subcontracts, similarly documented.

E. For changes in the Work performed on a time-and-materials basis, rental equipment is paid as follows:

1. Actual invoice cost for duration of time required to complete extra work without markup for overhead and profit. When extra work comprises only a portion of a rental invoice where equipment would otherwise be on site, compute hourly equipment rate by dividing the actual monthly invoice by 176. One day equals eight hours and one week equals 40 hours.

2. Do not exceed estimated operating costs given in Blue Book for items of equipment. Overhead and profit will be allowed on the operating cost.

F. For changes in the Work performed on a time-and-materials basis using Contractor-owned equipment, use Blue Book rates as follows:

1. Contractor-owned equipment will be paid at the Blue Book Rental Rate for the duration of time required to complete extra work without markup for overhead and profit. Utilized lowest cost combination of hourly, daily, weekly, or weekly rates. Use 150 percent of Rental Rate for double shifts, one extra shift per day, and 200 percent of Rental Rate for more than two shifts per day. Standby rates shall be 50 percent of appropriate Rental Rate shown in Blue Book. No other rate adjustments apply.

2. Do not exceed estimated operating costs given in Blue Book. Overhead and profit will be allowed on operating costs. Operating costs will not be allowed for equipment on standby.

1.05 CHANGE PROCEDURES

A. Changes to Contract Price or Contract Time can only be made by issuance of Change Order. Changes will be in accordance with requirements of General Conditions.

B. Public Works will advise of Minor Changes in the Work as authorized.

C. Request clarification of Drawings, Specifications, Contract documents or other information by Request for Information. Response by Public Works to Requests for Information does not authorize Contractor to perform tasks outside scope of work. Changes must be authorized as described in this Section.

1.06 PROPOSALS AND CONTRACT MODIFICATIONS

A. Public Works may issue Request for Proposal, which includes a detailed description of the proposed change with supplementary or revised Drawing and Specifications. Public Works may also request a proposal in response to a Request for Information. Prepare and submit the proposal within seven days or as specified in request.

B. Submit requests for Contract changes to Public Works describing proposed change and its full effect on the Work, with a statement describing reason for change and effect on Contract Price and Contract time including full documentation.

C. Design Consultant may review Change Orders.

1.07 WORK CHANGE DIRECTIVE

A. Public Works may issue a signed Work Change Directive instructing Contractor to proceed with a change in the Work. Work Change Directive will subsequently by incorporated into a Change Order.

B. Work Change Directives will describe changes in the Work and designate the method of determining change in Contract Price or Contract Time.

C. Proceed promptly to execute changes in the Work in accordance with the Work Change Directive.

1.08 STIPULATED PRICE CHANGE ORDER

A. A Stipulated Price Change Order will be based on an accepted proposal.

1.09 UNIT PRICE CHANGE ORDER

A. Where Unit Prices for affected items of the Work are included in Bid Form, the Change Order will be based on Unit Prices, subject to Articles 7 and 9 of General Conditions.

B. Where Unit Prices of the Work are not pre-determined in Bid Form, the Work Change Directive or accepted proposal will specify the Unit Prices to be used.

1.10 TIME-AND-MATERIAL CHANGE ORDER

A. Provide itemized account and supporting data after completion of change, within time limits indicated for claims in General Conditions.

B. Public Works will determine the change allowable in Contract Price and Contract Time as provided in General Conditions.

C. Maintain detailed records for work done on time-and-material basis as specified in Paragraph 1.04 above.

D. Provide full information required for evaluation of changes and substantiate costs for changes in the Work.

1.11 EXECUTION OF CHANGE DOCUMENTATION

A. Public Works will issue Change Orders, Work Change Directives, or Minor Change in the Work for signatures of Parties as described in General Conditions.

1.12 CORRELATION OF CONTRACTOR SUBMITTALS

A. For Stipulated Price Contracts, promptly revise Schedule of Values and Application for Payment forms to record authorized Change Orders as separate line item.

B. For Unit Price Contracts, the next monthly estimate of the Work after acceptance of a Change Order will be revised to include new items not previously included with appropriate Unit Prices.

C. Promptly revise progress schedules to reflect change in Contract Time, and to adjust time for other items of work affected by the change, and resubmit for review.

D. Promptly enter changes to on-site and record copies of Drawings, Specifications or Contract Documents as required in Section 01785-Project Record Documents.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used.

3.01

END OF SECTION

SECTION 01270

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for measurement and payment plus conditions for nonconformance assessment and nonpayment for rejected Products.

1.02 AUTHORITY

A. Measurement methods delineated in Specification sections are intended to complement criteria of this Section. In event of conflict, requirements of the Specification section shall govern.

B. Public Works will take all measurements and compute quantities accordingly.

C. Assist by providing necessary equipment, workers, and survey personnel.

D. Measurement and Payment paragraphs are included only in those Specification sections of Division 01 where direct payment will be made. Include costs in the total bid price for those Specification sections in Division 01 that do not contain Measurement and Payment paragraphs.

1.03 UNIT QUANTITIES SPECIFIED

A. Quantity and measurement estimates stated in the Agreement are for contract purposes only. Quantities and measurements supplied are placed in the Work and verified by Public Works will determine payment as stated in Article 9 of General Conditions.

B. When actual work required greater or lesser quantities than those quantities indicated in Bid Form, provide required quantities at Unit Prices contracted, except as otherwise stated in Article 9 of General Conditions.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement by Weight: Reinforcing steel, rolled or other metal shapes are measured by CRSI or AISC Manual of Steel Construction weights. Welded assemblies are measured by CRSI or AISC Manual of Steel Construction or scale weights.

B. Measurement by Volume:

1. Stockpile: Measured by cubic dimension using mean length, width, and height or thickness.

2. Excavation and Embankment Materials: Measured by cubic dimension using average end area method.

C. Measurement by Area: Measured by square dimension using mean length and width or radius.

D. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.

E. Stipulated Price Measurement: By unit designated in the Agreement.

F. Other: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

G. Measurement by Each: Measured by each instance or item provided.

H. Measurement by Lump Sum: Measure includes all associated work.

1.05 PAYMENT

A. Payment includes full compensation for all required supervision, labor, products, tools, equipment, plant, transportation, services, and incidentals; and erection, application or installation of an item of the Work; and Contractor's overhead and profit.

B. Total compensation for required Unit Price work shall be included in Unit Price bid in Bid Form. Claims for payment as Unit Price work, but not specifically covered in the list of Unit Prices contained in Bid Form, will not be accepted.

C. Interim payments for stored materials will be made only for materials to be incorporated under items covered in Unit Prices, unless disallowed in Supplementary Conditions.

D. Progress payments will be based on Public Works' observations and evaluations of quantities incorporated in the Work multiplied by Unit Price.

E. Final payment for work governed by Unit Prices will be made on the basis of actual measurements and quantities verified by Public Works multiplied by the Unit Price for work which is incorporated in or made necessary by the Work.

1.06 NONCONFORMANCE ASSESSMENT

A. Remove and replace work, or portions of the Work, not conforming to the Contract documents.

B. When not practical to remove and replace work, Public Works will direct one of the following remedies:

1. Nonconforming work will remain as is, but Unit Price will be adjusted lower at discretion of Public Works.

2. Nonconforming work will be modified as authorized by Public Works, and the Unit Price will be adjusted lower at the discretion of Public Works, when modified work is deemed less suitable then specified.

C. Specification sections may modify the above remedies or may identify a specific formula or percentage price reduction.

D. Authority of Public Works to assess nonconforming work and identify payment adjustment is final.

1.07 NONPAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in an unacceptable manner.

2. Products determined as nonconforming before or after placement.

3. Products not completely unloaded from transporting vehicles.

4. Products placed beyond lines and levels of required work.

5. Products remaining on hand after completion of the Work, unless specified otherwise.

6. Loading, hauling, and disposing of rejected Products.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01292

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation and submittal of Schedule of Values for Stipulated Price Contracts or for Major Unit Price Work on Unit Price Contracts.

1.02 PREPARATION

A. For Stipulated Price Contracts, subdivide the Schedule of Values into logical portions of the Work, such as major work items or work in contiguous construction areas. Use Section 01325-Construction Schedule as a guide to subdivision of work items. Directly correlate Items in the Schedule of Values with tasks in the Construction Schedule. Organize each portion using the Project Manual Table of Contents as an outline for listing value of the Work by Sections. A pro rata share of mobilization, Bonds, and insurance may be listed as separate items for each portion of the Work.

B. For Unit Price Contracts, items should include a proportional share of Contractor's overhead and profit so that total of all items will equal Contract Price.

C. For lump sum equipment items, where submittal of operation and maintenance data and testing are required, include separate items for equipment operation and maintenance data where:

1. Submittal of maintenance data is valued at five percent of the lump sum amount for each equipment item and

2. Submittal for testing and adjusting is valued at five percent of the lump sum amount for each equipment item.

Round off figures for each item listed to the nearest $100. Set the value of one item, when necessary, to make total of all values equal the Contract Price for Stipulated Price Contracts or the lump sum amount for Unit Price Work.

1.03 SUBMITTAL

A. Submit the Schedule of Values, in accordance with requirements of Section 01330-Submittal Procedures, at least 10 days prior to processing of the first Certificate for Payment.

B. Submit the Schedule of Values in an approved electronic spreadsheet file and an 8 ½-inch by 11-inch print on white bond paper.

C. Revise Schedule of Values for items affected by Contract Modifications. After Public Works has reviewed changes, resubmit at least 10 days prior to the next scheduled Certificate for Payment date.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01312

COORDINATION AND MEETINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General coordination including pre-construction meeting, site mobilization conference, and progress meetings.

1.02 COORDINATION OF DOCUMENTS

A. Coordination is required throughout documents. Refer to Contract documents and coordinate as necessary.

1.03 CONTRACT COORDINATION

A. Coordinate scheduling, submittals, and work of various Specification sections to assure efficient and orderly sequence of Installation of interdependent construction elements.

B. Coordinate completion and clean up of the Work prior to the Date of Substantial Completion and for portions of the Work designated for City's partial occupancy.

C. Coordinate access to the site for correction of nonconforming work to minimize disruption of the City's activities where the City is in partial occupancy.

1.04 PRE-CONSTRUCTION MEETING

A. Public Works will schedule pre-construction meeting.

B. Attendance Required: City representatives, Design Consultants, Special Consultants as required by Public Works, Contractor, and Major Subcontractors and Suppliers.

C. Agenda:

1. Distribution of Contract Documents.

2. Designation of personnel representing the Parties and Design Consultant.

3. Review of insurance.

4. Discussion of formats for Schedule of Values and Construction Schedule.

5. Procedures and processing of Shop Drawings, substitutions, pay estimates or Applications for Payment, Requests for Information, Requests for Proposal, Modifications, and the Contract closeout, other submittals.

6. Scheduling of the Work and coordination with other contractors.

7. Review of Subcontractors and Suppliers

8. Appropriate agenda items listed for the site mobilization conference, Paragraph 1.05.C, when pre-construction meeting and site mobilization conference are combined.

9. Procedures for testing.

10. Procedures for maintaining record documents.

1.05 SITE MOBILIZATION CONFERENCE

A. When required by Contract documents, Public Works will schedule a conference at the Project site prior to Contractor mobilization.

B. Attendance Required: City representatives, Design Consultant, Special consultants, Superintendent, and major subcontractors.

C. Agenda:

1. Use of premises by the City and Contractor.

2. Safety and first aid procedures.

3. Construction controls provided by the City.

4. Temporary utilities.

5. Survey and layout.

6. Security and housekeeping procedures.

7. Field office requirements.

1.06 PROGRESS MEETINGS

A. Hold meetings at Project field office or other location designated by Public Works. Hold meetings at monthly intervals, or more frequently when directed by Public Works.

B. Attendance Required: Superintendent, major Subcontractors and Suppliers, City representatives, Design Consultant and its subconsultants as appropriate for agenda topics for each meeting.

C. Design Consultant will make arrangements for meetings, and for recording minutes.

D. Design Consultant will prepare the agenda and preside at meetings.

E. Provide required information and be prepared to discuss each agenda item.

F. Agenda:

1. Review minutes of previous meeting.

2. Review of construction schedule, pay estimates, cash flow curve, payroll and compliance submittals.

3. Field observations, problems, and necessary decisions.

4. Identification of problems that impede planned progress.

5. Review of submittal schedule and status of submittals.

6. Review of RFI and RFP status.

7. Modification status.

8. Review of off-site fabrication and delivery schedules.

9. Maintenance of Construction Schedule.

10. Corrective measures to regain Construction Schedule.

11. Planned progress during the succeeding work period.

12. Coordination of projected progress.

13. Maintenance of quality and work standards.

14. Effect of proposed Modifications on Construction Schedule and Coordination.

15. Other item relating to the Work.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01321

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Photographic requirements for construction photographs and submittals.

1.02 DEFINITIONS

A. Pre-construction Photographs: Photographs taken, in sufficient numbers and detail, prior to Date of Commencement of the Work, to show original construction site conditions.

B. Progress Photographs: Photographs, taken throughout the duration of construction of regular intervals and from fixed vantage points, pre-approved by the City, that document progress of the Work.

C. Finished Photographs: Photographs, taken by a professional photographer near Date of Substantial Completion and before City Council's acceptance of the Work, that are suitable for framing and for use in brochures or on the Internet.

1.03 SUBMITTALS

A. Refer to Section 01330, Submittal Procedures, for submittal requirements.

B. Format and Media: Film or digital photography may be used. Submit color photographs, unless otherwise specified.

1. Prints: Submit each Progress or Pre-construction Photograph print in the three-hole plastic pocket or sleeve, bound in a three-ring notebook. Produce prints on photographic-quality paper approved by Public Works. Minimum size for Pre-Construction Photograph prints shall be 3-inches by 5-inches. Progress Photograph prints shall be 8-inches by 10-inches.

2. Film: Use 35 mm or larger color film. Submit negatives used to make submitted photographs, in 3-hole 8-1/2 inch by 11-inch plastic sheets with sleeves for negatives.

3. Digital Photography: Use 2.1 megapixel density or greater for photographs. Scanned photographs must equal or exceed 400 dots per inch when scanned from 8-inch by 10-inch prints. Submit digital photographic files on computer disks. Format disks for MS-DOS (Microsoft Disk Operating System) filing system and in JPEG (Joint Photographic Experts Group) format.

C. Submittal Quantities and Frequencies.

1. Pre-construction Photographs:

   a. For Stipulated Price Contracts, submit two sets of Pre-construction Photographs, if required, prior to first Application for Payment.
   b. For Unit Price Contracts, submit two sets of Pre-construction Photographs prior to start of construction operations.

2. Progress Photographs:

   a. For Stipulated Price Contracts, submit three sets of Progress Photographs with each Application for Payment at the times established for submittal of Applications for Payment. Monthly Applications for Payment shall be deemed incomplete if not accompanied by the required Progress Photographs. Contractor's failure or election to not submit a monthly Application for Payment shall not affect the requirement for monthly Progress Photographs.
   b. Progress Photographs are not required for Unit Price Contracts unless otherwise specified.

3. Finished Photographs: For Stipulated Price Contracts submit two sets of Finished Photographs, if required, after Date of Substantial Completion and prior to final payment. Each set shall contain one 11-inch by 14-inch matte finish color photographic print from each of the two vantage points pre-approved by the City. Vantage points for Finished Photographs will be approved separately from vantage points approved for Progress Photographs. Finished Photographs are not required for Unit Price Contracts unless otherwise specified.

D. Labeling: Place a label on the back of each photographic print, applied so as to not show through on the front. Labels shall contain the following information:

1. Name of Project, address of Project and GFS Number.

2. Name and address of Contractor.

3. Date photograph was taken.

4. Location photo taken from and short description of photo subject.

5. Name and address of professional photographer who took the photograph, if applicable.

E. Hand-deliver or transmit prints in standard photographic mailers marked “Photographs – Do Not Bend”.

F. Photographic prints, negatives, photographic files and disks become the property of the City. Do not publish photographs without written consent by the City.

1.04 QUALITY ASSURANCE

A. Contractor shall be responsible for the quality of and timely execution and submittal of photographs.

B. For Finished Photographs, Contractor shall use a professional photographer, with five years minimum professional experience in the Schertz area. Contractor shall submit name, address and credentials of professional photographers for Public Works’ review and approval.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION PHOTOGRAPHS

A. Prior to commencement of construction operations, photograph the site to include initial construction corridor, detour routes, and staging or storage areas.

1. For Stipulated Price Contracts, unless specified as a requirement in other Sections, these photographs are optional for Contractor, but are highly recommended for areas bounded by other property owners.

2. Pre-construction photographs are required for Unit Price Contracts. For line projects with scheduled construction segments, take Pre-construction Photographs prior to commencement of work on each segment.

B. Prepare Pre-construction Photographs as follows:

1. Show the following information on a non-reflective chalkboard placed within the picture frame:

a. Job number.
b. Project number.
c. Date and time photographs were taken (Automatic date/time in negative is acceptable).
d. Baseline station, direction of view (i.e. N, S, NW, etc.) and house number or street address and street name.

2. Pre-construction Photographs shall indicate condition of the following:

a. Esplanades and boulevards.
b. Yards (near side and far side of street).
c. House walks and sidewalks.
d. Curbs.
e. Areas between walks and curbs.
f. Particular features (e.g. yard lights, shrubs, fences, trees).

3. Show date photographs were taken on negatives.

C. Show the location of vantage points and direction of shots on a key plan of the site.

3.02 PROGRESS PHOTOGRAPHS

A. Progress Photographs document monthly advancement of the Work. Select vantage points for each shot so as to best show status of construction and progress since last photograph submittal. Select camera stations that will require little or no movement or adjustment over the duration of construction.

B. Take monthly Progress Photographs at regular intervals to coincide with cutoff dates associated with each Application for Payment.

3.03 FINISHED PHOTOGRAPHS

A. Finished Photographs shall be “staged” and taken by professional photographer to depict the most flattering images of a finished facility. Two vantage points, from which Finished Photographs will be taken, shall be agreed to in advance by the City. Photographer shall consider lighting, time of day, height of eye, landscaping and placement of vehicles, people and other props in each picture. Filters and post-photography processing may be utilized to achieve a finished product acceptable to the City.

3.04 LOCATION

A. Vantage points, times and conditions for camera stations and photography for Progress and Finished Photographs shall be mutually agreed upon by the City, Contractor and Photographer. Progress Photograph vantage points may be changed by mutual agreement as the Work progresses, at no additional cost to the City.

END OF SECTION

SECTION 01325

CONSTRUCTION SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide Construction Schedules for the Work included in this Contract in accordance with requirements in this Section. Create Construction Schedule using Critical Plat Method (CPM) computer software capable of mathematical analysis of Precedence Diagramming Method (PDM) plan. Provide printed activity listings and bar charts in format described in this Section.

B. Combine activity listings and bar charts with narrative report to form Construction Schedule submittal for Public Works.

1.02 SCHEDULING STAFF

A. Employ or retain services of individual experienced in CPM scheduling for duration of the Contract. Individual shall cooperate with Public Works and update schedule monthly as required to indicate current status of the Work.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330-Submittal Procedures.

B. During preconstruction meetings, as described in Section 01312-Coordination and Meetings, provide sample bar charts and activity listings produced from scheduling software proposed. Scheduling software is subject to review by Public Works and must meet requirements provided in this Section. Public Works will provide review of samples within seven days of submittal.

C. Within 21 days of receipt of approval of Contractor’s format, or 30 days of Notice to Proceed, whichever is later, submit proposed Construction Schedule for review. Base Construction Schedule submittal on the following:

1. Level of detail and number of activities required in schedule are dependent on project type.

    a. For wastewater projects, categorize work type

    b. For projects with multiple types of tasks within scope, indicate types of work separately within schedule.

c. For projects with work at different physical locations or service areas, or different facilities within a site, indicate each location or facility separately within schedule. Show work on each floor of multi-story building as separate tasks.

d. For projects with multiple crafts or significant Subcontractor components, indicate elements separately within schedule.

2. Unless permitted by Public Works, each scheduled task shall be same as Schedule of Values line item, and vice versa.

3. For projects with Major Unit Price Work, indicate Shop Drawing submittal and review, purchase, delivery, and Installation dates on Project schedule. Include activities for testing, adjustment, and delivering O&M manuals.

4. No task except the acquisition of Major Unit Price Work shall represent more than one percent of Original Contract Price for facility projects and three percent of Original Contract Price for other projects. Duration of tasks may not exceed 40 calendar days.

5. For projects where operating facilities are involved, identify each period of work that will impact any process or operation in the schedule and that must be agreed to by Public Works and facility operator prior to starting work in the area.

C. Construction Schedule submittals shall include:

1. Printed bar charts that meet criteria outlines in this Section and are produced by Contractor’s approved scheduling software;

2. Activity listings that meet criteria outlined in this Section and are produced by Contractor’s approved scheduling software; and

3. A predecessor/successor listing sorted by Activity ID that meets criteria outlines in this Section and is produced by Contractor’s scheduling software.

4. A logic network diagram is required with the first Construction Schedule submittal for facilities projects.

5. Prepare and submit graphic or tabular display of estimated monthly billings (i.e. cash flow curve for the Work) with the first schedule submittal. This information is not required in monthly updates, unless significant changes in work require re-submittal of schedule for review. Display shall allocate units indicated in bid schedule or Schedule of Values to Construction Schedule activities. Weighted

allocation are acceptable, where appropriate. Dollar value associated with each allocated unit will be spread across the duration of that activity on a monthly basis. Total for each month and cumulative total will be indicated. These monthly forecasts are only for Public Work's planning purposes. Monthly payments for actual work completed will be made in accordance with General Conditions.

6. Narrative Report that provides the information outlines in this Section.

E. No payment will be made until Public Works approves Construction Schedule and billing forecast.

F. If Contractor desires to make changes in its method of operating and scheduling, after Public Works has reviewed original schedule, notify Public Works in writing, stating reasons for changes. When Public Works considers these changes to be significant, Contractor may be required to revise and resubmit for review all or affected portion of Contractor's Construction Schedule to show effect of the Work.

G. Upon written request from Public Works, revise and submit for review all or any part of Construction Schedule submittal to reflect changed conditions in the Work or deviations made from original schedule.

H. Updated Construction Schedule with actual start and actual finish dates, percent complete, and remaining duration of each activity shall be submitted monthly. Data date used in updating monthly Construction Schedule shall be the same date as used in monthly Payment Application. Monthly update of Construction Schedule is required for monthly Payment Application to be processed for payment.

1.04 SCHEDULING COMPUTER SOFTWARE REQUIREMENTS

A. Contractor's scheduling software shall be capable of creating bar charts and activity listings, which can be sorted by various fields (i.e. Activity ID, Early Start, Total Float, Area Code, Specification Section Number, and Subcontractor). Use software capable of producing logic network diagrams.

B. Use scheduling software capable of producing activity listings and bar charts with the following information for each activity in the schedule:

1. Activity ID
2. Activity Description
3. Estimated (Original) Duration
4. Remaining Duration

5. Actual Duration
6. Early Start Date
7. Late Start Date
8. Early Finish Date
9. Late Finish Date
10. Free Float
11. Total Float
12. Activity Codes (such as Area Code, Work Type, Specification Section, Subcontractor)

C. Use scheduling software capable of printing calendars using mathematical analysis of schedule, indicating standard workdays of week and scheduled holidays.

D. Use scheduling software capable of printing activity listing that indicates predecessors and successors, lag factors and lag relationships used in creating logic of the schedule.

E. Use scheduling software to provide monthly time in Bar Chart format and scale with 12-month scale not to exceed one page width. Bar charts may be printed or plotted on 8-1/2 inch by 11 inch, 8-1/2 inch by 14 inch or 11 by 17 inch sheet sizes. Over-size plots are not acceptable.

1.05 NARRATIVE SCHEDULE REPORT

A. Narrative schedule report shall list activities started this month, activities completed this month, activities continues this month, activities scheduled to start or complete next month, problems encountered this month, and actions taken to solve these problems.

B. Narrative schedule report shall describe changes made to Construction Schedule logic (i.e. changes in predecessors and lags), activities added to schedule, activities deleted from schedule , any other changes made to the schedule other than addition of actual start dates and actual finish dates and changes of data date and remaining durations for re-calculation of mathematical analysis.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION

END OF SECTION

SECTION 01326

CONSTRUCTION SCHEDULE (BAR CHART)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide an initial Construction Schedule as required by this section for the Work. Do not start construction until Public Works reviews the schedule.

1.02 FORM AND CONTENT OF INITIAL CONSTRUCTION SCHEDULE

A. Bar Chart:

1. Show major construction activities such as pipe laying, by traffic control phases or other approved key areas; tunnel construction, pavement removal, pavement replacement, pressure testing, chlorination, clean up and punch list as separate activities on the schedule.

2. Show week duration for each activity.

3. Show separate activities for each Shop Drawing and Product Data submittal critical to timely completion. Show submittal dates and dates Public Works needs to provide approved submittals.

4. Provide separate horizontal bar for each activity. List start and finish date for each activity at left side of diagram.

5. Horizontal Time Scale: Identify first work day of each week.

6. Scale and Spacing: Notes must be legible. Allow space for notations and future revisions.

7. Order of Listings: Order bar charts listings by phases or other approved groups of activities that are contiguous. List activities in chronological order within each phase or group.

B. Narrative Description:

1. Submit narrative descriptions of anticipated work sequences as indicated by the sequence of activities presented in the schedule.

2. Discuss any activity that affects the public (such as phases of traffic control), interaction with specific forces of the City (such as valve operation, chlorination and testing) or other associated contractors.

1.03 PROGRESS REVISIONS

A. Submit progress revisions or necessary information to complete and process Payment Applications. When required, re-submittals for rejected revisions must be submitted and reviewed prior to the following month's processing of a Payment Application. The following month's Payment Application will not be processed until the re-submittal is reviewed and required progress revisions are received.

B. Provide a narrative report to describe:

1. Major changes in scope.

2. Revised projections in progress, completion, or changes in activity duration.

3. Other identifiable changes.

4. Problem areas, anticipated delays, and the impact on schedule.

5. Corrective action recommended and its effect.

6. Effect of changes on schedules or other contractors.

7. Product delivery lead times.

C. Include additional data with Bar Chart described in Paragraph 1.03A of this Section:

1. Show original dates for each activity in the approved initial progress schedule by narrow bar next to a wider bar for the current schedule.

2. Show date each activity actually started or finished when an event has occurred. Clearly identify actual dates in two right-most columns in left portion of an 11 by 17 inch chart.

3. Indicate the percentage progress to the date of submittal for each activity.

1.04 SUBMITTALS

A. Submit the initial progress schedule within 15 days after award of contract. Public Works will review the schedule and return a reviewed copy within 21 days after receipt.

B. Cut-off dates for progress revisions may be as early as the 20th of the month to avoid delaying processing of Payment Applications. Use the cut-off date for the first approved revision for further revisions.

C. When required, re-submit within seven days after return of review copy.

D. Include connecting lines between bars in the schedule to indicate the sequence that activities will be accomplished. Connecting lines when the activity's start or finish is modified will identify impact of preceding or succeeding activities. Submit a minimum of six copies of the bar chart on 11 by 17 inch opaque reproductions. Public Works will retain five copies and return the remaining copy.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION– Not Used.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures for:

1. Schedule of Values
2. Construction Schedules and Cash Flow Curve (billing forecast).
3. Shop Drawings, Product Data and Samples.
4. Operations and Maintenance (O&M) Data
5. Manufacturer's Certificates
6. Construction Photographs.
7. Project Record Documents and monthly certificate.
8. Video Tapes.
9. Design Mixes.

1.02 SUBMITTAL PROCEDURES

A. Scheduling and Handling:

1. Submit Shop Drawings, data and Samples for related components as required by Specifications and Public Works.
2. Schedule submittals well in advance of need for construction Products. Allow time for delivery of Products after submittal approval.
3. Develop submittal schedule that allows sufficient time for initial review, correction, resubmission and final review of all submittals. Allow a minimum of 30 days for initial review. Public Works will review and return submittals to Contractor as expeditiously as possible but time required for review will vary depending on complexity and quantity of data submitted.

4. Public Work's review of submittals covers only general conformity to Drawings, Specifications and dimensions that affect layout. Contractor is responsible for quantity determination. No quantities will be verified by Public Works. Contractor is responsible for errors, omissions or deviations from Contract requirements; review of submittals does not relieve Contractor from the obligation to furnish required items in accordance with Drawings and Specifications.

5. Submit five copies of documents unless otherwise specified.

6. Revise and resubmit submittals as required. Identify all changes made since previous submittal.

7. Assume risk for fabricated Products delivered prior to approval. Do not incorporate Products into the Work, or include payment for Products in periodic progress payments, until approved by Public Works.

B. Transmittal Form and Numbering:

1. Transmit each submittal to Public Works with Transmittal letter which includes:

   a. Date and submittal number.
   b. Project title and number.
   c. Names of Contractor, Subcontractor, Supplier and Manufacturer.
   d. Identification of Product being supplied.
   e. Location of where Product is to be Installed.
   f. Applicable Specification section number.

2. Identify deviations from Contract documents clouding submittal drawings. Itemize and detail on separate 8 ½ by 11 inch sheets entitled "DEVIATIONS FOR _____." When no deviations exist, submit a sheet stating no deviations exist.

3. Have design deviations signed and sealed by an appropriate design professional, registered in the State of Texas.

4. Sequentially number transmittal letters beginning with number one. Use original number for re-submittals with an alphabetic suffix (i.e., 2A for the first re-submittal 2, or 15C for third re-submittal of submittal 15, etc.) Show only one type of work or Product on each submittal. Mixed submittals will not be accepted.

C. Contractor's Stamp:

1. Apply Contractor's Stamp certifying that the items have been reviewed in detail by Contractor and that they comply with Contract requirements, except as noted by requested variances.

2. As a minimum, Contractor's Stamp shall include:

   a. Contractor's name
   b. Job number
   c. Submittal number
   d. Certification statement Contractor has reviewed submittal and it is in compliance with the Contract.
   e. Signature line for Contractor.

D. Submittals will be returned with of the following Responses:

1. "ACKNOWLEDGE RECIEPT" when no response and re-submittal is required.

2. "NO EXCEPTION" when sufficient information has been supplied to determine that item described is accepted and that no re-submittal is required.

3. "EXCEPTIONS AS NOTED" when sufficient information has been supplied to determine that item will be acceptable subject to changes, or exceptions, which will be clearly stated. When exceptions require additional changes, the changes must be submitted for approval. Re-submittal is not required when exceptions required no further changes.

4. "REJECTED-RE-SUBMIT" when submittal does not contain sufficient information, or when information provided does not meet Contract requirements. Additional data or details requested by Public Works must be submitted to obtain approval.

1.03 MANUFACTURER'S CERTIFICATES

A. When required by Specification sections, submit manufacturer's certificate of compliance for review by Public Works.

B. Place Contractor's Stamp on front of certification.

C. Submit supporting reference data, affidavits, and certifications as appropriate.

D. Product certificates may be recent or from previous test results, but must be acceptable to Public Works.

1.04 DESIGN MIXES

A. When required by Specification sections, submit design mixes for review.

B. Place Contractor's Stamp, as specified in this Section, on the front of each design mix.

C. Mark each mix to identify proportions, gradations, and additives fro each class and type of mix submitted. Include applicable test results from samples for each mix. Perform tests and certifications within 12 months of the date of the submittal.

D. Maintain copies of approved mixes at mixing plant.

1.05 CHANGES TO CONTRACT

A. Changes to Contract may be initiated by completing a Request for Information form. Public Works will provide a response to Contractor by completing the form and returning it to Contractor.

1. If Contractor agrees that the response will result in no increase in cost or time, a Minor Change in the Work will be issued by Public Works.

2. If Contractor and Public Works agree that an increase in time or cost is warranted, Public Works will forward the Request for Proposal for negotiation of a Change Order.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION– Not Used.

END OF SECTION

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Methods, schedules, and processes to be followed for Shop Drawings, Product Data and Sample submittals.

1.02 REQUIREMENT

A. Submit Shop Drawings, Product Data and Samples as required by General Conditions and Specification sections, using procedures specified in Section 01330-Submittal Procedures and the requirements of this Section.

B. Shop Drawings, Product Data and Samples are not considered Contract documents.

1.03 SHOP DRAWINGS/SUBMITTAL SCHEDULE

A. Submit a separate Shop Drawing submittal schedule at same time the Construction Schedule is submitted. List Products for which Shop Drawings and other submittals are required in the order that they appear in Specifications. Include Product Data and Sample submittals in the schedule. Payment Applications or Certificates for Payment will not be processed until Public Works has approved the Shop Drawing submittal schedule.

1.04 SHOP DRAWINGS

A. Submit a minimum of five sets of Shop Drawings and Product Data in a form and quality suitable for microfilming. Review and sign Shop Drawings indicating compliance with the Contract.

B. Place Contractor’s Stamp on each drawing as described in Section 01330-Submittal Procedures.

C. Show the following accurately and distinctly:

1. Field and erection dimensions;

2. Arrangement and section views;

3. Relation to adjacent materials or structure, including complete information for making connections between the Work and work under other contracts;

4. Types of Products and finishes;

5. Parts list and descriptions;

6. Assembly drawings of equipment components and accessories showing respective positions and relationships to the complete equipment package;

7. Identify details by referencing drawing sheet and detail numbers, schedule or room numbers as shown on the Contract drawings, where necessary for clarity.

D. Scale drawings to provide a true representation of the specific equipment or item furnished.

E. Coordinate and submit components, necessary for Public Works to adequately review submittal, as a complete package. Reproduction of the Drawings for use in Shop Drawings is not allowed.

F. For major changes to original documents, submit Computer-Aided Design (CAD) drawings on a media acceptable to Public Works.

1.05 PRODUCT DATA

A. Submit Product Data for review as required in Specifications.

B. Place Contractor's stamp, on each data item submitted, as described in Section 01330-Submittal Procedures.

C. Mark each copy to identify applicable Products, models, and options to be used in the Work. Where required by Specifications, supplement manufacturer's standard data to provide information unique to the Work.

D. Give manufacturers, trade name, model or catalog designation and applicable reference standard for Products specified only by reference standards.

E. Pre-approved and Pre-qualified Products.

1. For "pre-approved", "pre-qualified" and "approved" Products named in the City standard product list, provide an appropriate list

designation, as described in Section 01630-Product Substitution Procedures, within 30 days after Notice to Proceed.

2. For Products proposed as alternates to “approved” products, provide information required to demonstrate that the proposed Products meet the level of quality and performance criteria of the “approved” product.

1.06 SAMPLES

A. Submit Samples for review as required by Specifications. Have Samples reviewed and signed by a Registered Professional.

B. Place Contractor’s stamp on each Sample or firmly attach a sheet of paper with Contractor’s stamp, as described in Section 01330-Submittal Procedures.

C. Submit the number of Samples specified in Specifications; Public Works will retain one.

D. Reviewed Samples that may be used in the Work are identified in Specifications.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01410

TPDES REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000 (the Construction General Permit).

B. Implementation, maintenance inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Drawings or specified elsewhere in the Contract.

C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with Public Works prior to start of construction.

1.02 DEFINITIONS

A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.

B. Large Construction Activity: Project that:

1. disturbs five acres or more, or

2. disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.

C. Small Construction Activity: Project that:

1. disturbs one or more acres but less than five acres, or

2. disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.

D. TPDES Operator:

1. The Contractor shall be the operator as defined by TPDES

General Permit. The operator will prepare, submit SWP3 plans and permits and have day-to-day operational control of the construction activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

E. Municipal Separate Storm Water Sewer System (MS4) Operator:

1. The City of Schertz Public Works is the MS4 Operator who maintains the streets, channels, gutters, ditches or anything else that is publicly owned, designed or used to collect or transport storm water.

PART 2 P R O D U C T S -Not Used

PART 3 E X E C U T I O N

3.01 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Prepare a SWP3 following TCEQ Part III of the Construction General Permit Number 150000.

B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.

C. Submit the SWP3 and any updates or revisions to Public Works for review and address comments prior to commencing, or continuing, construction activities.

3.02 NOTICE OF INTENT For Large Construction Activity

A. Prepare and submit TCEQ Form 20022 Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000). See TCEQ website for Storm Water Permits for Construction: http://www.tceq.state.tx.us/nav/permits/wq_construction.html

B. Submission of the Notice of Intent form to TCEQ is required a minimum of seven days before Commencement of Construction Activities.

C. The Contractor shall provide Public Works with copies of submitted notifications and associated records of payment.

3.03 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

A. Prepare and post the Construction Site Notice, to TPDES General Permit TXR 150000, "Construction Site Notice". See TCEQ website for Storm

Water Permits for Construction: http://www.tceq.state.tx.us/nav/permits/wq_construction.html

B. At least 2 days before beginning construction, provide a copy of the site notice to the operator of any Municipal Separate Storm Water Sewer System (MS4) into which storm water will be discharged.

C. Adhere to the requirements of General Permit TXR 150000 and no notice of intent (NOI), notice of termination (NOT), or fee is required under this option—as long as the requirements of this general permit are followed

3.04 CERTIFICATION REQUIREMENTS

A. Fill out TPDES Operator's Information form, **ATTACHMENT 3** of this Section 01410, including Contractor's name, address, and telephone number, and the names of persons or firms responsible for maintenance and inspection of erosion and sediment control measures. Use multiple copies as required to document full information.

B. Contractor and Subcontractors shall sign and date the Contractor's / Subcontractor's Certification for TPDES Permitting, **ATTACHMENT 4** of this Section 01410. Include this certification with other Project certification forms.

C. Submit properly completed certification forms to Public Works for review before beginning construction operations.

D. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the Construction Inspection Form, **ATTACHMENT 5** of this Section 01410; and the City of Schertz Storm Water Pollution Prevention Plan Construction Site Inspection Report, **ATTACHMENT 6** of this Section 01410 to record maintenance inspections and repairs.

3.05 RETENTION OF RECORDS

A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon

submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to Public Works.

3.06 REQUIRED NOTICES

A. Post the following notices from effective date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:

1. Post the TPDES permit number for Large Construction Activity or a signed TCEQ Construction Site Notice for Small Construction Activity.

2. Post notices near the main entrance of the construction site in a prominent place for public viewing. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.

a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with Public Works to conform to requirements of the Construction General Permit.

b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.

3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction exit area.

4. Post a notice of waste disposal procedures in a readily visible location on site.

3.07 ON-SITE WASTE MATERIAL STORAGE

A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.

B. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.

C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3

3.08 NOTICE OF TERMINATION

A. Submit a Notice of Termination (NOT),to TCEQ within 30 days after:

1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or

2. Another operator has assumed control over all areas of the site that have not been stabilized; and

3. All silt fences and other temporary erosion controls have either been removed, are scheduled to be removed as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage.

END OF SECTION

ATTACHMENT 1
Notice of Intent
(Most up-to-date version to be obtained from TCEQ website
http://www.tceq.state.tx.us/nav/permits/wq_construction.html
also available for electronic submittal)

ATTACHMENT 2
Construction Site Notice
(Most up-to-date version can be obtained from TCEQ website
http://www.tceq.state.tx.us/nav/permits/wq_construction.html
also available for electronic submittal)

ATTACHMENT 3

TPDES OPERATOR'S INFORMATION

Owner's Name and Address: City of Schertz

Mr. _____
(City Official)

(Department) _____

1400 Schertz Parkway
Schertz, Texas 78154
(210) 619-1000

Contractors' Names and Addresses:

Contractor General: _____
_____
_____
_____
Telephone:

Site Superintendent: _____
_____
_____
_____
Telephone:

Erosion Control and Maintenance Inspection: _____
_____
_____
_____
Telephone:

Subcontractors' Names and Address:

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
Telephone Telephone

Note: Insert name, address, and telephone number of person or firms

ATTACHMENT 4

CONTRACTOR'S / SUBCONTRACTOR'S

CERTIFICATION FOR TPDES PERMITTING

I certify under penalty of law that I understand the terms and conditions of TPDES General Permit No. TXR150000 and the Storm Water Pollution Prevention Plan for the construction site identified as part of this certification.

Signature: _____

Name: (**printed or typed**) _____

Title: _____

Company: _____

Address: _____

Date: _____

Signature: _____

Name: (**printed or typed**) _____

Title: _____

Company: _____

Address: _____

Date: _____

Signature: _____

Name: (**printed or typed**) _____

Title: _____

Company: _____

Address: _____

Date: _____

ATTACHMENT 5

Storm Water Construction Site Inspection Report

General Information			
Project Name			
NPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Describe present phase of construction			
Type of Inspection **❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event**			
Weather Information			
Has it rained since the last inspection? ❑Yes ❑No **If yes, provide:** **Storm Start Date & Time: Storm Duration (hrs): Approximate Rainfall (in):**			
Weather at time of this inspection?			
Do you suspect that discharges may have occurred since the last inspection? ❑Yes ❑No			
Are there any discharges at the time of inspection? ❑Yes ❑No			

Site-specific BMPs

Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of this numbered site map with you during your inspections. This list will help ensure that you are inspecting all required BMPs at your site. Customize this section as needed.

	BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Date for corrective action/responsible person
1		❑Yes ❑No		
2		❑Yes ❑No		
3		❑Yes ❑No		
4		❑Yes ❑No		
5		❑Yes ❑No		
6		❑Yes ❑No		
7		❑Yes ❑No		
8		❑Yes ❑No		
9		❑Yes ❑No		
10		❑Yes ❑No		

	BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Date for corrective action/responsible person
11		❑Yes ❑No		
12		❑Yes ❑No		
13		❑Yes ❑No		
14		❑Yes ❑No		
15		❑Yes ❑No		
16		❑Yes ❑No		
17		❑Yes ❑No		
18		❑Yes ❑No		
19		❑Yes ❑No		
20		❑Yes ❑No		

Below are some general site issues that should be assessed during inspections. Please customize this list as needed for conditions at your site.

Overall Site Issues

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No		
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No		
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No		
4	Are discharge points and receiving waters free of sediment deposits?	❑Yes ❑No	❑Yes ❑No		
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No		
6	Is there evidence of sediment being tracked into the street?	❑Yes ❑No	❑Yes ❑No		
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No		

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No		
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No		
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No		
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No		
12	(Other)	❑Yes ❑No	❑Yes ❑No		
13	(Other)	❑Yes ❑No	❑Yes ❑No		

Certification statement:
"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name: _____

Signature: _____

Date: _____

ATTACHMENT 6

City of Schertz

Storm Water Pollution Prevention Plan
Construction Site Inspection Report

TPDES/EPA Permit Number_____
DATE _____

- ❑ No exceptions noted.

The following must be corrected prior to continuing work:

- ❑ Public Notice improperly posted
- ❑ Initial Construction Site Inspection Report information requires updating
- ❑ Copy of NOI not on site
- ❑ Storm water pollution prevention plan not on site
- ❑ Erosion and sediment controls improperly installed
- ❑ Erosion and sediment control devices improperly maintained
- ❑ Fueling or washout areas not properly protected
- ❑ Portocan or other sanitary facilities not properly protected
- ❑ Self-inspection and maintenance records incomplete
- ❑ Sediment from site outside area of construction
- ❑ Other (see description below)

_____

_____

Please Contact the Public Works at
10 Commercial Place, Bldg #2, Schertz, Texas 78154
210-619-1800 fax 210-619-1849

Once the above items have been corrected, call to arrange for re-inspection. No further inspections for any construction related activity shall be made until the above items have been corrected.

_____ _____
Inspector's Signature Contractor's Signature

_____ _____
Inspector's Name Contractor's Name

ATTACHMENT 7
Notice of Termination
(Most up-to-date version can be obtained from TCEQ website
http://www.tceq.state.tx.us/nav/permits/wq_construction.html
also available for electronic submittal)

SECTION 01422

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes general quality assurance as related to Reference Standards and a list of references.

1.02 QUALITY ASSURANCE

A. For Products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on the date as stated in the General Conditions.

C. Request clarification from Public Works before proceeding should specified reference standards conflict with Contract documents.

1.03 SCHEDULE OF REFERENCES

AASHTO American Association of State Highway
And Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333-9094

AGC Associated General Contractors of America
333 John Carlyle Street
Alexandria, VA 22314

AI Asphalt Institute
Research Park Drive
P.O. Box 14052
Lexington, KY 40512

AITC American Institute of Timber Construction
7012 S. Revere Parkway, Suite 140
Englewood, CO 80112

AISC	American Institute of Steel Construction One East Wacker Drive Chicago, IL 60601
AISI	American Iron and Steel Institute 1101 17t Street NW, Suite 1300 Washington, DC 20036
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016
ANSI	American National Standards Institute 1819 L Street NW Sixth Floor Washington, DC 20036
APA	American Plywood Association Box 11700 Tacoma, WA 98411
API	American Petroleum Institute 1220 L Street NW Washington, DC 20005
AREA	American Railway Engineering and Maintenance-of-Way-Association 8201 Corporate Drive, Suite 1125 Landover, Maryland 20785
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, PA 19428
AWPA	American Wood-Preservers' Association P.O. Box 5690 Granbury, Texas 76049

AWS	American Welding Society 550 NW 42nd Avenue Miami, FL 33126
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
COS	City of Schertz 1400 Schertz Pkwy Schertz, Texas 78154
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Parkway, Suite 300 Columbia, MD 21046
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, UL. 60173-4758
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FS	Federal Standardized Documents General Services Administration Specifications Unit (WFSIS) 7th and D Streets, S.W. Washington, DC 20406
ICEA	Insulated Cable Engineer Association P.O. Box 440 S. Yarmouth, MA. 02664
IEEE	Institute of Electrical and Electronics Engineers 445 Hoes Lane P.O. Box 440 Piscataway, NJ 08855-459
ISA	International Society of Arboriculture P.O. Box 3129 Champaign, IL. 61826-3129

MIL	Military Specifications General Services Administration Specifications Unit (WFSIS) 7th and D Streets, S.W. Washington, DC 20406
NACE	National Association of Corrosion Engineers 1440 South Creek Drive Schertz, Texas 77084-4906
NEMA	National Electrical Manufacturer's Association 1300 North 17th Street, Suite 1847 Rosslyn, VA. 22209
NFPA	National Fire Protection Association 1 Batterymarch Park P.O. Box 9101 Quincy, MA. 02269-9101
OSHA	Occupational Safety Health Administration U.S. Department of Labor Office of Public Affairs – Room N3647 Washington, DC. 20210
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077-1083
PCI	Prestressed Concrete Institute 209 W. Jackson Blvd. Chicago, IL. 60606
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL. 60021
SSPC	Society for Protective Coatings (Steel Structures Painting Council) 40 24th Street, Sixth Floor Pittsburgh, PA. 15222

TAC	Texas Administrative Code http://info.sos.state.tx.us/pls/pub/readtac$ext.viewtac P.O. Box 13087 Library MC-196 Austin, Texas 78711-3087
TxDOT	Texas Department of Transportation 125 East 11th Street Austin, Texas 78701-2483
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
UNI-BELL	UNI-BELL Pipe Association 2655 Villa Creek Drive, Suite 155 Dallas, Texas 75234

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01450

CONTRACTOR'S QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance and control of Installation and manufacturer's field services and reports.

1.02 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

A. Monitor quality control over Suppliers, manufacturers, Products, Services, Site Conditions and Workmanship, to produce work of specified quality at no additional cost to the City.

B. Comply fully with manufacturer's Installation Instructions, including each step in sequence.

C. Request clarification from Public Works before proceeding should manufacturer's instructions conflict with the Contract.

D. Comply with specified standards as minimum requirements for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform the Work by persons qualified to produce a specified level of workmanship.

1.03 REFERENCES

A. Obtain copies of standards and maintain at job site when required by individual Specification sections.

1.04 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification sections, or as required by Public Works, provide Product suppliers' or manufacturers' technical representative to observe site conditions, conditions of surfaces and Installation, quality of workmanship, start-up of equipment, operator training, testing, adjusting and balancing of equipment a applicable and to initiate required operation. Conform to minimum time requirements for start-up operations and operator training when provided in Specification sections.

B. At Public Work's request, submit qualifications of manufacturers' representative to Public Works 15 days in advance of required representatives' services. Representative is subject to approval by Public Works.

C. Manufacturers' representative shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to a manufacturer's written instructions. Submit report within 14 days of observation to Public Works for review.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01452

INSPECTION SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inspection services and references

1.02 INSPECTION

A. Public Works will appoint an Inspector to represent the City and perform inspections, tests, and other services specified in individual Specification Sections.

B. Public Works may also appoint, employ, and pay an independent firm to provide additional inspection or construction management services as indicated in Section 01454 -Testing Laboratory Services.

C. The independent firm will submit reports to Public Works, indicating observations and results of tests and indicating compliance or noncompliance with Contract requirements.

D. Contractor shall assist and cooperate with the Inspector; furnish samples of materials, design mix, equipment, tools, and storage.

E. Contractor shall notify Public Works 24 hours prior to expected time for operations requiring services.

F. Contractor shall sign and acknowledge reports for Inspector.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01454

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing laboratory services and Contractor responsibilities related to those services.

1.02 REFERENCES

A. ASTM C 1077-Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

B. ASTM D 3666-Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

C. ASTM D 3740-Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

D. ASTM E 329-Standard Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

E. ISO/TEC Guide 25-General Requirements for the Competence of Calibration and Testing Laboratories.

1.03 SELECTION AND PAYMENT

A. The City will select, employ, and pay for services of an independent testing laboratory to perform inspection and testing identified in Part 3 of individual Specification sections.

B. Contractor shall employ and pay for services of an independent testing laboratory or laboratories to perform inspection and testing identified in Part 2 of individual Specification sections.

C. Employment of a testing laboratory by the City shall not relieve Contractor of its obligation to perform work in accordance with requirements of Contract documents.

D. The City will deduct a minimum two-hour charge for testing laboratory time from periodic progress payment when operations requiring testing or inspection are canceled without prior notification.

E. The City will deduct cost of retesting from periodic progress payment whenever failed work is removed, replaced or retested.

1.04 QUALIFICATION OF LABORATORY

A. Meet laboratory requirements of ASTM E 329 and applicable requirements of ASTM C 1077, ASTM D 3666, and ASTM D 3740.

B. Meet ISO/TEC Guide 17025 conditions for accreditation by the American Association for Laboratory Accreditation (A2LA) in specific fields of testing required in individual Specification sections.

C. If laboratory subcontracts are part of the testing services, such work will be placed with a laboratory complying with the requirements of this Section.

1.05 LABORATORY REPORTS

A. Testing laboratory shall provide and distribute copies of laboratory reports to the distribution list Public Works provides at the pre-construction conference.

B. Keep one copy of each laboratory report distributed or faxed at the site field office for duration of the Work.

C. Laboratory will fax material supplier, Contractor and Public Works reports that indicate failing test results by no later than close of business on the working day following test completion and review.

1.06 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge requirements of the Contract.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume Contractor duties.

D. Laboratory has no authority to stop the Work.

1.07 CONTRACTOR RESPONSIBILITIES

A. Provide safe access to the Work and to manufacturer's facilities for Public Works and for testing laboratory personnel.

B. Provide testing laboratory with a copy of the Construction Schedule and a copy of each update to Construction Schedule.

C. Notify Public Works and testing laboratory during normal working hours of the day previous to expected time for operations requiring inspection and testing services. When Contractor fails to make timely prior notification, do not proceed with the operations requiring inspection and testing services.

D. Notify design Consultant 24 hours in advance when Specification required presence of Design Consultant for sampling or testing.

E. Request and monitor testing as required to provide timely results and to avoid delays to the Work. Provide samples to laboratory in sufficient time to allow required test to be performed in accordance with specified test methods before intended use of the Product.

F. Cooperate with laboratory personnel in collecting samples on site. Provide incidental labor and facilities for safe access to the Work to be tested, to obtain and handle sampled at site or at source of Products to be tested, and to facilitate tests and inspections including storage and curing of test samples.

G. Make arrangement with laboratory through Public Works. Payment for additional testing will be made in accordance with Document 00700-General Conditions:

1. Re-testing required for failed tests.

2. Re-testing for nonconforming work.

3. Additional sampling and tests requested beyond specified requirements.

4. Insufficient notification of cancellation of tests for work scheduled but not performed.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION

3.01 CONDUCTING TESTING

A. Conform to laboratory sampling and testing methods specified in individual Specification sections to the latest issues of ASTM standards, methods, or other recognized test standards as approved by Public Works.

B. Requirements of this Section shall also apply to those tests for approval of materials, for mix designs, and for quality control of materials as performed by employed testing laboratories.

END OF SECTION

SECTION 01502

MOBILIZATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mobilization of construction equipment and facilities onto the site.

1.02 MEASUREMENT AND PAYMENT

A. Unit Price Contracts. If Contract is Unit Price Contract, measurement for mobilization is on a lump sum basis.

B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work is this Section is included in total Stipulated Price.

C. Mobilization payments will be included in monthly payment estimates upon written application by Contractor subject to the following provisions:

1. Authorization for payment of 50 percent of that portion of Contract Price designated for mobilization will be made upon receipt and approval by Public Works of the following items, as applicable:

   a. Safety Program (General Conditions, Article 5).
   b. Schedule of Values (Section 01292), if any.
   c. Initial Construction Photographs (Section 01321), if needed.
   d. Preliminary Construction Schedule and Billing Forecast (Section 01325).
   e. Construction Schedule (Section 01325 or Section 01326, as applicable).
   f. Submittal Schedule (Section 01330).
   g. Site specific Storm Water Pollution Prevention Plan (SWPPP) and Notice of Intent (NOI) along with storm water application fee (Section 01410), if required.
   h. Contractor’s Quality Control Plan (Section 01450), if required.
   i. Establishment of a Field Office for Public Works meeting requirements of Section 01520 -Temporary Field Office, when as office is required by the Contract.
   j. Traffic Control Plan (Section 01555), if required.
   k. Plan for Control of Ground and Surface Water (Section 01578), if required.
   l. Project Signs Submittal (Section 01580).

m. Trench Safety Program (Section 02260), if required.
n. Dewatering plan, when required.

2. Authorization for payment of 90% of the balance of that portion of Contract Price designated for mobilization will be made upon completion of the Work amounting to five percent of Original Contract Price. The final 5% will be paid after approval of the required close-out documents in accordance with Section 01770. The amount of Contract Price designated for mobilization may not be applied in computing whether or not five percent of the Original Contract Price has been obtained.

3. Mobilization payments will be subject to retainage amounts stipulated in Document 00700-General Conditions.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

SECTION 01504

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary facilities and necessary controls for the project, including utilities, telephone, sanitary facilities, storage sheds and building, safety requirements, first aid equipment, fire protection, security measures, protection of the Work and property, access roads and parking, environmental controls, pest and rodent control and disposal of trash, debris and excavated material.

B. Facilities and controls specified in this section are considered minimum for the Project. Provide additional facilities and controls for proper execution of the Work and to meet Contractor's responsibilities for protection of person and property.

1.02 CONTRACTOR'S RESPONSIBILITY

A. Comply with applicable requirements specified in other sections of Specifications.

1. Maintain and operate temporary facilities and systems to assure continuous service.

2. Modify and extend systems as the Work progress requires.

3. Completely remove temporary materials and equipment when no longer required.

4. Restore existing facilities used for temporary services to specified or original condition.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION

3.01 TEMPORARY UTILITIES

A. Obtaining Temporary Service:

1. Make arrangements with utility service companies for temporary services.

2. Abide by rules and regulations of the utility service companies or authorities having jurisdiction.

3. Be responsible for utility service costs until Date of Substantial Completion. Included are fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of the Work.

B. Water:

1. Provide water required for and in connection with work to be performed and for specified tests of piping, equipment, devices, or for other use as required for proper completion of the Work.

2. Water to be drawn from public fire hydrants. Obtain meter from City of Schertz, Public Works Department. Pay required deposit based on rates established by latest ordinance.

3. Provide and maintain an adequate supply of potable water for domestic consumption by Contractor personnel, Public Works, and representatives of the City.

C. Electricity and Lighting:

1. Provide electrical power service required for the Work including required testing, lighting, operation of equipment, and other Contractor use.

2. Electric power service includes temporary power or generators required to maintain plant operations during scheduled shutdowns.

3. Minimum lighting level shall be 10 foot candles for open areas; 20 foot candles for stairs and shops. Provide a minimum of one 300 watt lamp for each 200 square feet of work area.

D. Temporary Heat and Ventilation:

1. Provide temporary heat necessary for protection or completion of the Work.

2. Provide temporary heat and ventilation to assure safe working conditions; maintain enclosed areas at a minimum of 50 degrees F.

E. Telephone:

1. Provide emergency telephone service at Project site for use by Contractor personnel and others performing work or furnishing services at the site.

F. Sanitary Facilities:

1. Provide and maintain sanitary facilities for person on the site; comply with regulations of State and local department of health.

2. Enforce use of sanitary facilities by construction personnel at site. Enclose sanitary facilities. Pit-type toilets are not permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as to not cause a nuisance or health problem. Haul sewage and waste off-site and properly dispose in accordance with applicable regulations.

3. Locate toilets near the Work site and secluded for view insofar as possible. Keep toilets clean and supplied throughout the course of the Work.

3.02 STORAGE SHEDS AND BUILDINGS

A. Provide adequately ventilated, watertight storage facilities with floor above ground level for Products susceptible to weather changes.

B. Storage of Products not susceptible to weather damage may be on blocks off the ground.

C. Store Products in a neat and orderly manner. Place Products to permit easy access for identification, inspection and inventory.

D. Fill and grade site for temporary structures to provide drainage away from temporary and existing buildings.

3.03 SAFETY REQUIREMENTS

A. Submit a safety program at the pre-construction meeting and follow the program in accordance with General Conditions. Include documented response to trench safety requirements of Section 02260-Trench Safety System.

B. Conduct operations in strict accordance with applicable Federal, State and local safety codes and statutes and with good construction practice. Establish and maintain procedures for safety of all work, personnel and equipment involved in the Work.

C. Observe and comply with Texas Occupational Safety Act (Art. 5182A, V.C.S.) and with all safety and health standards promulgated by Secretary of Labor under Section 107 of Contract Work Hours and Standards Act, published in 29 CFR Part 1926 and adopted by Secretary of Labor as occupational safety and

D. Observance of and compliance with safety regulations is Contractor's responsibility without reliance or superintendence of or direction by Public Works. Immediately advise Public Works of investigation or inspection by Federal Safety and Health inspectors of Contractor's or subcontractor's work or place of work on site under the Contract, and after investigation or inspection, advise Public Works of results. Submit on copy of accident reports to Public Works within 10 days of occurrence.

E. Protect areas occupied by workmen using the best available devices for detection of lethal and combustible gases. Test devices frequently to assure functional capability. Constantly observe infiltration of liquids into the Work area for visual or odor evidence of contamination, and immediately take appropriate steps to seal off entry of contaminated liquids to the Work area.

F. Implement safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment and other safety equipment specified or detailed on Drawings.

G. Maintain required coordination with Emergency Services during entire period covered by the Contract.

H. Include Project safety analysis in safety plan. Itemize major tasks and potential safety hazards. Plan to eliminate hazards or protect workers and public from each hazard.

3.04 FIRST AID EQUIPMENT

A. Provide a first aid kit throughout the construction period. List telephone numbers for physicians, hospitals, and ambulance services in each first aid kit.

B. Have at least one person thoroughly trained in first aid and CPR procedures present on the site when work is in progress. Contractor to conform to protocols and requirements for training and protection against "blood borne pathogens".

3.05 FIRE PROTECTION

A. Conform to specified fire protection and prevention requirements established by Federal, State, or local governmental agencies and as provided in Safety Program.

3.06 SECURITY MEASURES

A. Protect the Work, materials, equipment, and property from loss, theft, damage, or vandalism. Protect City property used in performance of the Contract.

B. If existing fencing or barriers are breached or removed for purposes of construction, provide and maintain temporary security fencing equal to existing.

3.07 PROTECTION OF UTILITIES AND PIPELINES

A. Prevent damage to existing public utilities during construction. Approximate locations of known utilities are shown on Drawings, but all lines may not be shown. Excavate with caution and repair lines damaged by construction operations.

B. Texas One Call System, which must be called 48 hours in advance. The toll free telephone number is 1-800-DIG-TESS.

C. Before excavating, locate underground utilities by appropriate means including the use of metal detection equipment, and probes, or by excavation or surveys. Repair damage caused by investigative work and by failure to locate or to preserve underground utilities.

D. Give utility owners a minimum five days notice before commencing excavation to allow time to locate utilities and make adjustments or relocations when they conflict with the Work. Include cost for temporary relocation of water, wastewater, and storm drainage lines, necessary to accommodate construction, in unit prices for utility construction unless otherwise noted. By passing of sanitary waste to storm drainage facilities is not allowed.

E. Prior to excavation near pipelines, request a representative of the pipeline company to meet with Contractor and Public Works at the site to discuss procedures to be used. Request pipeline company's representative to locate the pipelines in a least three locations: at each side and at centerline of proposed excavation of proposed utility. Also request representative and Public Works to be present to observe Contractor operations when excavation is conducted within 15 feet of pipeline.

3.08 PROTECTION OF THE WORK AND PROPERTY

A. Preventive Action

1. Take necessary precautions and actions to prevent damage, injury, or loss to the Work or public and private property, including:

    a. Storage or apparatus, supplies, and Products in an orderly, safe manner to limit interference with progress of the Work or work of other contractors, utility service companies, or the City's operations.
    b. Suitable storage for Products subject to damage by exposure to weather, theft, breakage, etc.
    c. Limitation of loading pressures imposed upon portions of the Work.
    d. Frequent clean up of refuse, scrap materials, and debris from construction operations, necessary to maintain the site in a safe and orderly condition.
    e. Provision of barricades and guard rails to protect pedestrian and traffic around openings, scaffolding, temporary stairs and ramps, excavation, elevated walkways, and other hazardous areas.

2. Protect public and private property adjacent to the site. Obtain written consent before entering or occupying privately-owned land except on easements provided for construction. Restore property damaged by construction operations to condition equal to or better then that existing before the damage.

B. Barricades and Warning Systems

1. Where work is performed on or adjacent to roadways, rights-of-ways, or public land, provide barricades, fences, lights, warning signs, danger signals, and other precautionary measures necessary for protection of persons or property and for protection of the Work.

    a. Erect sufficient barricades to keep vehicles and pedestrians from entering the Work. Paint barricades to be visible at night. From sunset to sunrise, provide at least one light at each barricade.
    b. Maintain barricades, signs, lights, and provide watchmen until Public Works approved removal. Whenever work creates encroachment onto public roadways, station flagmen to manage traffic flow in accordance with approved traffic control plan.

c. Conform to requirements of section 01555-Traffic Control and regulation.

3.09 PROTECTION OF EXISTING STRUCTURES

2. Underground Facilities

a. Known Underground Facilities are shown on the Drawings but all Facilities may not be shown. Explore sufficiently ahead of trenching and excavation work to locate Underground Facilities in order to prevent damage to them and to prevent interruption of utility services. Restore damage to Underground Facilities to original condition at no additional cost to the City.
b. If necessary to avoid unanticipated Underground Facilities, Public Works may make changes in location of the Work.
c. If permanent relocation of an Underground Facility is required and not provided for in the Contract documents, Public Works will direct Contractor in writing to perform the Work under Modification provisions in General Conditions.

3. Surface Structures include buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks, guard cables, fencing, and other facilities that are visible above the ground level.

4. Protection of Underground Facilities and Surface Structures:

a. Support in place and protect Underground Facilities and Surface Structures located within or adjacent to the limits of the Work from damage. Install supports as required by the owner of the structure. Satisfy Public Works that the owner of the facility or structure has approved methods and procedures before installing structure supports.
b. Avoid moving or changing public utility or private corporation property without prior written consent of a responsible official or the facility or structure. Allow representatives of utilities to enter the construction site for maintenance and repair purposes or to make necessary changes.
c. Notify utility and pipeline owners and operators of the nature of construction operations and dates when operations will be performed. When construction operations are required in immediate vicinity of existing structures, pipelines, or utilities, give a minimum of five working days advance notice. Probe and flag location of Underground Facilities prior to

commencement of excavation. Keep flags in place until construction operations uncover the facility.

d. Assume risk for damages and expenses to Underground Facilities and Surface Structures within or adjacent to the Work.

C. Employ a structural engineer to ensure protection measures are adequate for the safety and integrity of structures and facilities.

3.10 PROTECTION OF INSTALLED PRODUCTS:

1. Provide protection of Installed Products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of the Work.

2. Control traffic to prevent damage to Products and surfaces.

3. Provide coverings to protect Products from damage. Cover projections, wall corners, jambs, sills, and exposed sides of openings in areas used for traffic and passage of materials in subsequent work.

3.11 ROADS AND PARKING

A. Prevent interference with traffic and operations of the City on existing roads.

B. Designate temporary parking areas to accommodate construction and City personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by Public Works.

C. Minimize use by construction traffic on existing streets and driveways.

D. Do not allow heavy vehicles or construction equipment in existing parking areas.

3.12 ENVIRONMENTAL CONTROLS

A. Use methods, equipment, and temporary construction necessary for control of environmental conditions at the site and adjacent areas.

B. Comply with statutes, regulations, and ordinances relating to prevention of environmental pollution and preservation of natural resources including National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.

C. Minimize impact to the surrounding environment. Do not use construction procedures that cause unnecessary excavation and filling of terrain, indiscriminate destruction of vegetation, air or stream pollution, or harassment or destruction of wildlife.

D. Limit disturbed areas to boundaries established by the Contract. Do not pollute on-site streams, sewers, wells, or other water sources.

E. Do not burn rubbish, debris, or waste materials.

3.13 POLLUTION CONTROL

A. Provide methods, means, and facilities necessary to prevent contamination of soil, water or the atmosphere by discharge of Pollutants from construction operations.

B. Provide equipment and personnel to perform emergency measures to contain spillage, and to remove contaminated soils or liquids. Excavate and dispose of contaminated earth off-site in accordance with laws and regulations, and replace with suitable compacted fill and topsoil.

C. Provide systems necessary for control of Pollutants.

1. Prevent toxic concentrations of chemicals.

2. Prevent harmful dispersal of Pollutants into the environment.

D. Use equipment that conforms to current Federal, State and local laws and regulations.

3.14 PEST AND RODENT CONTROL

A. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.

B. Employ methods and use materials that will not adversely affect conditions at site or on adjoining properties.

3.15 NOISE CONTROL

A. Provide vehicles, equipment, and use construction activities that minimize noise to the greatest degree practicable. Conform to City Ordinance No. 09-H-03, § III, 1-20-2009, and latest OSHA standards. Do not permit noise levels to interfere with the Work or create a nuisance to surrounding areas.

B. Conduct construction operations during daylight hours except as approved by Public Works.

C. Select construction equipment that operates with minimum noise and vibration. When directed by Public Works, correct objectionable noise or vibration produced by operation of equipment at no additional cost to the City. Sound Power Level (PWL) of equipment shall not exceed 85 dbA (re: 10-12 watts) measured five feet from the equipment, or at a lower level. Equipment noise requirements are contained in equipment specifications.

3.16 DUST CONTROL

A. Use water or other methods approved by Public Works to control amount of dust generated by vehicle and equipment operations.

3.17 WATER RUNOFF AND EROSION CONTROL

A. Comply with requirements of section 01410 -TPDES Requirements.

B. Conduct fill, grading and ditching operations and provide adequate methods necessary to control surface water, runoff, subsurface water, and water from excavations and structures in order to prevent damage to the Work, the site, or adjoining properties.

1. Plan and execute construction and earthwork by methods that control surface drainage from cuts and fills, and from borrow and waste disposal areas.

2. Minimize area of bare soil exposed at one time.

3. Provide temporary control measures, such as berms, dikes, and drains.

4. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

5. Construct fill and waste areas by selective placement of materials to eliminate erosion of surface silts or clays that may erode.

6. Direct water away from excavation, pits, tunnels, and other construction areas to prevent erosion, sedimentation or damage.

7. Maintain existing drainage patterns adjacent to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover.

8. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to the site or adjoining areas, in conformance with environmental requirements.

9. Inspect earthwork periodically to detect any evidence of erosion. Take corrective measures as required to control erosion.

END OF SECTION

SECTION 01520

TEMPORARY FIELD OFFICE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field office building and associated parking area.

1.02 FACILITY DESCRIPTION

A. Temporary field office to be utilized by authorized representatives of the City to coordinate and monitor daily construction activities performed by Contractor.

B. Field office shall be a non-smoking facility.

PART 2 PRODUCTS

2.01 FIELD OFFICE

A. General:

1. Locate office in vicinity of the Work at a location approved by Public Works or where indicated on Drawings.

2. Furnish, Install and maintain field office for exclusive use of authorized representatives of the City. Provide sufficient room for Project meetings and Inspector's office.

3. Provide office within 10 days of Date of Commencement of the Work.

4. Construct two all-weather, hard surfaced parking spaces for exclusive use of authorized representatives of the City. Provide all-weather surfaced walk between parking spaces and field office.

B. Minimum Construction:

1. Structurally sound foundation and superstructure.

2. Weather tight with insulated roof, walls and 7-foot ceiling (minimum).

3. Stairs or walkway with handrail and covered entrance platform (minimum 4 feet by 4 feet) with mud scraper at door.

4. Resilient floor covering.

SECTION 01506

DIVERSION PUMPING

PART 1 GENERAL

1.01 DEFINITIONS

A. Diversion-pumping: Installation and operation of bulkheads, plugs, hoses, piping, and pumps required to maintain sewer flow and prevent backups and overflows.

1.02 SYSTEM DESCRIPTION

A. Provides continuous sewer service to users of sewer systems while maintenance or construction operations are in progress, by diverting flow around construction locations. Maintain sewer flow to prevent backup or overflow onto streets, yards, and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways. Do not divert sewage outside of sanitary sewer system.

B. When pumps are operating, have an experienced operator on site to monitor operation, adjust pumps, make minor repairs to system, and report problems.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittals Procedures.

B. For systems that bypass sanitary sewer line segments of 8-inch diameter and larger, submit a Diversion Pumping Plan prior to installation. Show location, number and size of pumps, number, location, size and type of hoses or rigid piping, and location of downstream, discharge; and special features where pipes or hoses cross roadways, temporary trenches, support bridges.

1.04 SCHEDULING

A. When the City operates or maintains diversion pumping in construction areas, coordinate construction activities with Public Works.

B. Cease operation of diversion pumping when approved by Public Works.

PART 2 PRODUCTS

2.01 MATERIALS

A. Design piping, joints and accessories to withstand at least twice maximum system pressure or 50psi, whichever is greater.

B. Use self-priming type or submersible electric pumps, with a working pressure gauge on the discharge.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. During diversion pumping, do not allow sewage to leak, dump, or spill into or onto areas outside of existing sanitary sewer systems.

B. In the event of an accidental spill or overflow, immediately stop discharge and take action to clean up and disinfect spill. Promptly notify Public Works so required reporting can be made to the Texas Commission on Environmental Quality (TCEQ) and the Environmental Protection Agency (EPA).

3.02 CLEANING

A. When diversion-pumping operations are complete, drain sewage within piping into sanitary sewers prior to disassembly.

END OF SECTION

5. Screened windows with area equal to approximately 10 percent of floor area sufficient for light, view of the site, and ventilation. Provide each window with operable sash and burglar bars.

6. Secure exterior doors with dead-bolt cylinder locks and burglar bars.

C. Minimum Services:

1. Exterior entrance light.

2. Interior lighting of 75 foot-candles minimum at desktop height.

3. Automatic heating to maintain 65 degrees F in winter.

4. Automatic cooling to maintain 75 degrees F in summer.

5. Electric power service.

6. Three telephone service lines one for voice, one for data, and one for fax, for exclusive use of authorized representatives of the City.

7. Sanitary facilities in field office with one water closet, one lavatory, and one medicine cabinet for exclusive use of authorized representatives of the City.

D. Minimum Furnishings:

1. One 5-drawer desk

2. Two swivel desk chairs with casters.

3. One plan table.

4. One drawing plan rack.

5. One 4-drawer legal file cabinet complete with fifty legal-size hanging folders and two full-sized carriers.

6. One marker board with cleaner and markers.

7. Two waste baskets.

8. One 30-inch by 36-inch tack board.

9. One all-purpose fire extinguisher.

10. Six protective helmets (hard hats) with ratchet adjustment for

exclusive use of authorized representatives of the City.

11. Conference table and chairs to accommodate 10 persons.

12. Plain paper fax machine.

13. Telephone instrument separate from fax machine.

E. Provide adequate space for one set of Contract documents for ready reference.

PART 3 EXECUTION

3.01 MAINTENANCE

A. Maintain all-weather surface driveway and parking areas, buildings, walkways, stairs and required furnishings and equipment for duration of the Contract.

B. Provide janitorial services for duration of the Contract consisting of twice weekly sweeping and mopping floors, trash removal, weekly restroom cleaning, and weekly dusting of furniture and equipment.

C. Provide soap, paper towels, toilet paper, cleansers and other necessary consumables.

D. Immediately repair damage, leaks or defective service.

3.02 PROJECT CLOSEOUT

A. Remove temporary field office and signs and restore site as specified in Section 01770 - Closeout Procedures.

END OF SECTION

SECTION 01555

TRAFFIC CONTROL AND REGULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.

B. Qualifications and requirements for use of flagmen.

1.02 MEASUREMENT AND PAYMENT

A. Unit Price Contracts.

1. Traffic control and regulation. Payment for traffic control and regulation is on a lump sum basis. Include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of traffic control devices, equipment, and personnel necessary to protect the Work and public. Payment will be based on Contractor's Schedule of Values for traffic control and regulation.

2. Flagmen. Payment for flagmen is on a lump sum basis. Partial payments will be based on Contractor's Schedule of Values for flagmen.

3. New Portable Concrete Low Profile Traffic Barrier Provided. Payment is on a unit price basis for each linear foot of low profile traffic barrier provided, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.

4. Portable Concrete Low Profile Traffic Barrier. Payment is on a unit price basis for each linear foot of low profile traffic barrier picked up from designated stockpile, moved onto the project, set at location and connected together.

5. Portable Concrete Low Profile Traffic Barrier Installed. Payment is on a unit price basis for each linear foot of low profile traffic barrier delivered to the project location, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.

6. Portable Concrete Low Profile Traffic Barrier Moved and Reset. Payment is on a unit price basis for each linear foot of low profile traffic barrier disassembled, moved on the project, reset at the new locations and connected together. Include cost to repair roadway in the unit price.

7. Portable Concrete Low Profile Traffic Barrier Removed. Payment is on a unit price basis for each linear foot of low profile traffic barrier removed from the project, including hardware assemblies, and stockpiling at location listed in Section 01110-Summary of Work. Include cost to repair roadway in the unit price.

8. Refer to Section 01270-Measurement and Payment for unit price procedures.

B. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.03 REFERENCES

A. Texas Manual on Uniform Traffic Control Devices (TMUTCD).

B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas code of Criminal Procedure.

C. Code of Ordinances, City of Schertz, Texas.

1. Chapter 78, Article V., Section 78-121 Right-of-Way Construction

1.04 SUBMITTALS

A. Conform to requirements of Section 01330-Submittal Procedures.

B. Traffic control plans:

1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.

2. If using a different traffic control plan, submit the plan for approval. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer.

C. Submit copies of traffic control plan at least 48 hours prior to implementing traffic control devices.

1.05 FLAGMEN

A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes.

B. Uniformed Peace Officer: Individual employed full-time as a peace officer who received separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.

1. Uniformed Peace Officers may be:

   a. sheriffs and their deputies;
   b. constables and deputy constables;
   c. marshals or police officers of an incorporated city, town or village; or
   d. as otherwise provided by Article 2.12, Code of Criminal Procedure.

2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the Federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.

C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:

1. Formally trained and certified in traffic control procedures by the City's requirements.

2. Speaks English, Ability to speak Spanish is desirable but not required.

3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City's Wage Scale for Engineering Construction.

D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

A. Comply with TMUTCD requirements.

B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.

2.02 PORTABLE LOW PROFILE CONCRETE BARRIERS

A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

PART 3 EXECUTION

3.01 PUBLIC ROADS

A. Submit traffic control plan to Public Works for approval at least 5 days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approval.

B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Public Works.

C. Give Public Works 5 days notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.

D. Notify Emergency Services in writing a minimum of five business days prior to beginning work.

E. Maintain 10-foot-wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.

F. Do not obstruct flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Public Works.

G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Public Works to maintain temporary driveway access to commercial and residential driveways.

H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.

I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.

J. Provide safe access for pedestrians along major cross streets.

K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.

L. Do not close more than two consecutive esplanade openings at a time without prior approval from Public Works.

3.02 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the City's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.03 FLARES AND LIGHTS

A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.04 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.05 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits,

traffic signal wiring and crosswalk signals. Notify the Public Works a minimum of 60 days in advance of need for control boxes and switchgear. The City will perform necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.

B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.

C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.

D. Unless otherwise approved by Public Works, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.

E. Replace existing traffic control devices in Project area.

F. Public Works may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the City.

3.06 BRIDGING TRENCHES AND EXCAVATIONS

A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.

B. Shore trench or excavation to support bridge and traffic

C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:

1. bridging is placed under existing bus routes,

2. more than five percent of daily traffic is comprised of commercial or truck traffic,

3. more than two separate plates are used for bridging, and

4. when bridge is to be used for more than five consecutive days.

D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.07 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

3.08 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:

1. multi-lane vehicular traffic must be diverted into single lane vehicular traffic,

2. vehicular traffic must change lanes abruptly,

3. construction equipment must enter or cross vehicular traffic lanes and walks,

4. construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks,

5. traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and

6. where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.09 INSTALLATION STANDARDS

A. Place temporary pavement markings for single lane closures, in accordance with TMUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Public Works. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to Public Works for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Public Works. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Public Works. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.

C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Obtain approval of Public Works to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION

SECTION 01562

TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tree and plant protection and maintenance.

B. Planting new trees and relocating and replanting existing trees.

C. Maintenance of planted or replanted trees.

1.02 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit name and experience of qualified Arborist, proposed for use on the Work, to Public Works.

1.03 PROJECT CONDITIONS

A. Preserve and protect existing trees and plants that are to remain; from damage to foliage, branches, trunk, or roots; that could result from construction operations.

B. Do not remove any Tree unless Parks and Recreation Department grants written permission for removal.

C. Prevent following types of damage:

1. Compaction of root zone by foot, vehicular traffic, or material storage.

2. Trunk damage from equipment operations, material storage, or from nailing or bolting.

3. Trunk and branch damage caused by ropes or guy wires.

4. Root poisoning from spilled solvents, gasoline, paint, and other noxious materials.

5. Branch damage due to improper pruning or trimming.

6. Damage from lack of water due to:

a. Cutting or altering natural water migration patterns near root zones.
b. Failure to provide adequate watering.

7. Damage from alteration of soil pH factor caused by depositing lime, concrete, plaster, or other base materials near roots.

8. Cutting of roots larger than 1-1/2 inches in diameter.

1.04 DAMAGE ASSESSMENT

A. When an ornamental tree on private property or an otherwise protected or heritage tree, as defined by the Code, other than those permitted for removal, are destroyed or badly damaged as result of construction operations, remove and replace according to the City's requirements for tree mitigation as outlined in Article 21.9.9.D. Mitigation will be at Contractors expense.

B. If any oak tree is wounded by intentional damage or pruning or as a result of natural causes, the damaged area shall be immediately treated with tree wound dressing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Obtain approval from Parks Department for tree wound dressing, fungicide, or insecticide.

B. Burlap: Suitable for use as tree wrapping.

C. Fertilizer: Liquid containing 20 percent nitrogen, 10 percent phosphorus, and 5 percent potash.

D. Obtain Public Works approval of replacement trees.

PART 3 EXECUTION

3.01 PROTECTION

A. Trees within Project area, except for trees shown on Drawings or directed by Public Works to be removed and relocated, are to remain in place. Protect from damage and maintain trees that are to remain.

B. Perform the following for trees or shrubs that are to remain:

1. Trim trees and shrubs under supervision of a professional tree surgeon or horticulturist.

    a. Prune trees according to International Society of Arbor culture specifications.
    b. Prune trees and shrubs requiring pruning for construction operations for balance and to maintain proper form and branching habit.
    c. Cut limbs at branch collar and remove stubs. Do not gouge outer layer of tree structure or trunk.
    d. Prior to construction, prune all trees to remain of new or recent growth to maintain basic branching form of trees. Base extent of pruning upon proximity of pavement to trunk and size of tree blockouts and requirements of construction adjacent to tree.
    e. Limit pruning of young branches to the maximum extent possible. Maintain older branches that provide basic form of tree. Prune in the presence of Public Works.
    f. Paint exposed, living tissue of cuts over 3/4" in diameter with tree paint.

2. Use extreme care to prevent excessive damage to root systems.

    a. Cut tree roots in construction area smoothly with a trencher before excavating. Do not allow ripping of roots with backhoes or other equipment.
    b. Temporarily cover exposed roots with wet burlap to prevent roots from drying out.
    c. Cover exposed roots with soil as soon as possible.

3. Prevent damage or compaction of root zone (area below drip line) by construction activities.

    a. Do not allow equipment to scar trunks or limbs
    b. Do not store construction materials, vehicles, or excavated material under drip line of trees.
    c. Do not pour liquid materials under drip line.

4. Water and fertilize remaining trees and shrubs to maintain their health during construction period.

    a. Water landscaping during construction operations at least once every seven days in cold months and once every four

days in hotter months.

b. Saturate soils to at least 6 to 8 inches beneath surface.

5. Water areas currently being served by private sprinkler systems while systems are temporarily taken out of service to maintain health of existing landscapes.

6. With Public Works' permission, shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist.

3.02 PROTECTION

A. Protection of Trees or Shrubs in Open Area:

1. Install steel drive-in fence posts in protective circle, approximately 8 feet on center, not closer than 4 feet to trunk of trees or stems of shrubs.

2. Insert steel drive-in fence posts a minimum of 3 feet into ground, leaving a minimum of 5 feet above ground.

3. Mount fluorescent orange construction fence on fence posts.

4. For trees or shrubs in paved areas, use movable posts consisting of two 1/2-inch minimum diameter concrete-filled steel pipe mounted in rubber automobile tires filled with concrete.

B. Provide timber wrap protection for trees in close proximity to equipment when work is required within construction fencing.

1. Wrap trunk with a layer of burlap.

2. Install vertical 5 to 6 foot long 2 by 4's or 2 by 5's, spaced 3 to 5 inches apart, around circumference of tree trunk.

3. Tie burlap in place with 12 to 9 gauge steel wire.

3.03 RELOCATING AND PLANTING NEW TREES

A. Employ a qualified Arborist, acceptable to Public Works, to plant and to move and relocate trees. Arborist must be normally engaged in the field and have a minimum of five years experience.

3.04 MAINTENANCE OF NEWLY PLANTED TREES AND REPLANTED TREES

A. Provide proof of capability to water trees during dry periods.

B. Maintain newly planted trees, in healthy condition until end of one-year warranty.

1. Straighten leaning trees.

2. Replace dead trees or trees that, in the opinion of Public Works, have become unhealthy, unsightly or have lost their natural shape as result of additional growth, improper pruning, maintenance or weather conditions, within four weeks of notice from Public Works.

3. When a tree must be replaced, a new warranty period shall commence on date of tree replacement, and Public Works' approval. Minimum warranty period shall be one year.

4. Dispose of rejected trees.

END OF SECTION

SECTION 01570

STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Section 01410 - TPDES Requirement.

B. Installation and maintenance of storm-water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, down spout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to final development of the site.

C. Filter Fabric Fences: Temporary filter fabric fences for erosion and sediment control in non-channelized flow areas.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

1. This item shall be paid as “Lump Sum” for Storm Water Pollution Prevention Plan. This price shall be full compensation for furnishing all labor, materials, supplies, equipment and incidentals necessary to include payment of all permit fees. The “Lump Sum” price shall also be full compensation for removal and replacement and proper disposal of control measures not incorporated as permanent control measures. The lump sum will be pro-rated based on the number of calendar days in the project contract. Failure to complete the work within time allowed in the project contract due to approving designs, testing, material shortages, closed construction season, curing periods, and testing periods will not qualify for additional compensation.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCE STANDARDS

A. ASTM

1. A 36 - Standard Specification for Carbon Structural Steel.

2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics.

4. D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).

5. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

6. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

7. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

8. D 6382 - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.

1.04 SYSTEM DESCRIPTIONS

A. Filter Fabric Fence Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Fences to remain in proper position and configuration at all times.

B. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area or runoff from project area into sediment traps.

C. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.

D. Sediment traps: Construct to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit manufacturers catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.

D. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.

E. Submit shop drawings for Drop Inlet Baskets.

PART 2 PRODUCTS

2.01 CONCRETE

A. Concrete: Class B in accordance with Section 03315 - Concrete for Utility Construction or as shown on the Drawings.

2.02 AGREGATE MATERIALS

A. Use poorly graded cobbles with diameter greater than 3 inches and less than 5 inches.

B. Provide gravel lining in accordance with Section 2320 - Utility Backfill Materials or as shown on the drawings.

C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.

D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.03 PIPE

A. Polyethylene culvert pipe or PVC sewer pipe in accordance with Section 02505- High Density Polyethylene (HDPE) Solid and Profile Wall Pipe and Section 02506 Polyvinyl Chloride Pipe or as shown on the Drawings.

B. Inlet Pipes: Galvanized steel pipe in accordance with Section 02642 Corrugated Metal Pipe or as shown on the Drawings.

C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

2.01 GEOTEXTILE FILTER FABRIC

A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.

B. Filter Fabric for Temporary Sediment Control Fence to meet the following minimum standards. Grab Tensile: 100 psi in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (ASTM D-3786), and apparent opening size between 20 and 50. Ultraviolet Resistence at 80% minimum at 500 hours

2.02 FENCING

A. Wire Fencing: Galvanized welded wire mesh, at least 12.5 gauge, max opening size of 2-inch x 4-inch, minimum 24 inch roll or sheet width of longest practical length.

B. Fence Stakes: Nominal 2 by 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 18 inch bury and full height of filter fabric.

2.03 SANDBAGS

A. Provide woven material made of polypropylene, polyethylene, or polyamide material.

1. Minimum unit weight of four ounces per square yard.

2. Minimum grab strength of 100 psi in any principal direction (ASTM D4632)

3. Mullen burst strength exceeding 300 psi (ASTM D3786).

4. Ultraviolet stability exceeding 70 percent.

5. Size: Length:18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: 50 to 125 pounds.

2.04 DROP INLET BASKET

A. Provide steel frame members in accordance with ASTM A36.

B. Construct top frame of basket with two short sides of 2 inch by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1 inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

PART 3 EXECUTION

3.01 PREPARATION, INSTALLATION AND MAINTAINANCE

A. Provide erosion and sediment control structures at locations shown on the Drawings.

B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Public Works to allow installation of erosion and sediment control systems, soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Public Works to remove and discard existing system.

D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. Redress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by Public Works. Dispose of materials in accordance with Section 01576 - Waste Material Disposal.

E. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Section 01576 - Waste Material Disposal.

F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Section 02315 Roadway Excavation or Section 2317 Excavation and Backfill for Utilities.

G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control

structures.

H. Protect existing trees and plants in accordance with Section 1562 - Tree and Plant Protection.

3.02 SEDIMENT TRAPS

A. Install sediment traps so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.

B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately.

C. Use fill material for embankment in accordance with Section 02320 - Utility Backfill Materials.

D. Excavation length and height shall be as specified on Drawings. Use side slopes of 2:1 or flatter.

E. Stone outlet sediment traps:

1. Maintain minimum of 6 inches between top of core material and top of stone outlet, minimum of 4 inches between bottom of core material and existing ground and minimum of 1 foot between top of stone outlet and top of embankment.

2. Embed cobbles minimum of 4 inches into existing ground for stone outlet. Core shall be minimum of 1 foot in height and in width and wrapped in triple layer of geotextile filter fabric.

F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.

G. Remove sediment deposits when design basin volume is reduced by one-third or sediment level is one foot below principal spillway crest, whichever is less.

3.03 SEDIMENT CONTROL FENCE CONSTRUCTION METHODS

A. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow.

B. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet apart or steel fence stakes spaced a maximum of 8 feet apart and embedded a

minimum of 18 inches. Install stakes at a slight angle toward source of anticipated runoff.

1. Securely fasten filter fabric material to wire fence with tie wires at spacing of 15" minimum. Attach welded wire fence and fabric to fence stakes at minimum 4 evenly spaced staples or t-clips.

2. Connect successive reinforcement sheets/rolls a minimum of 6 times with hog rings.

C. Remove sediment deposits when silt reaches depth one-third height of barrier or 6 inches, whichever is less.

D. Trench in toe of filter fabric fence so that downward face of trench is flat and perpendicular to direction of flow, 4" minimum against trench wall and 2" minimum against trench floor.

E. Backfill and compact trench upon completion of Construction.

F. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.

F Cut length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6 inch overlap and seal securely.

3.04 DIKE AND SWALE

A. Unless otherwise indicated, maintain minimum dike height of 18 inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.

B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.

C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.

D. Clear in accordance with Section 2233 - Clearing and Grubbing Compact embankments in accordance with Section 2315 - Roadway Excavation.

E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2:1 or flatter. Clear, grub and strip excavation area of vegetation and root material.

3.05 DOWN SPOUT EXTENDER

A. Down spout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Section 2317 - Bedding and Backfill for Utilities.

3.06 PIPE SLOPE DRAIN

A. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.

B. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.

C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.

D. Pipe shall be secured with hold-down grommets spaced 10 feet on centers.

E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slopes.

3.07 PAVED FLUME

A. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.

B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.

C. Construct permanent paved flumes in accordance with Drawings.

D. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

3.08 LEVEL SPREADER

A. Construct level spreader on undisturbed soil and not on fill. Ensure that

spreader lip is level for uniform spreading of storm runoff.

B. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.09 INLET PROTECTION BARRIER

A. Place sandbags and filter fabric fences at locations shown on the SWP3.

3.10 DROP INLET BASKET CONSTRUCTION METHODS

A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.

B. Support for inlet insert basket shall consist of fabricated metal.

C. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6 inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.

D. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 STREET AND SIDEWALK CLEANING

A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Section 01575-Stabilized Construction Exit.

B. In lieu of or in addition to stabilized construction exits, shovel or sweep pavements as required to keep areas clean. Do not waterhose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.12 WASTE COLLECTION AREAS

A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.13 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.

B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

C. Equipment leaking oils or chemicals will not be allowed on the construction site. Equipment with leaks discovered during operation will be repaired immediately or removed from the site. Contractor will have “drip pans” available on site to capture liquids during non-operational hours.

3.14 VEHICLE/ EQUIPMENT WASHING AREAS

A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction exit(s), as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Section 01575- Stabilized Construction Exit. Install gravel or rock base beneath wash areas.

B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into watercourses or storm water conveyance systems.

C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

3.15 WATER RUNOFF AND EROSION CONTROL

A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

B. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.

C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water to prevent flooding, erosion, or other damage to the site or adjoining areas. Follow environmental requirements.

E. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as required to control conditions.

F Plan and execute construction and earth work to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.

1. Hold area of bare soil exposed at one time to a minimum.

2. Provide temporary controls such as berms, dikes, and drains.

G. Construct fill and waste areas by selective placement to eliminate surface silts or clays which will erode.

H. Inspect earthwork periodically to detect start of erosion. Immediately apply corrective measures as required to control erosion.

I. Dispose of sediments offsite, not in or adjacent to streams or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.

J. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in maximum of 8-inch layers. Provide compaction density at minimum 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.

K. Do not maneuver vehicles on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.

L. Do not damage existing trees intended to remain.

3.16 REMOVAL OF CONTROLS

A. Remove erosion and sediment controls when the site is finally stabilized or as directed by Public Works.

B. Dispose of sediments and waste products following Section 01505-Temporary Facilities.

END OF SECTION

SECTION 01575

STABILIZED CONSTRUCTION EXIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of erosion and sediment control for stabilized construction exits used during construction and prior to final development of site.

1.02 MEASUREMENT AND PAYMENT

A. Unit Price Contracts. If Contract is Unit Price Contract, payment for work in this Section will be covered under the Lump Sum Item for Storm Water Pollution Plan.

B. Stipulated Price (Lump Sum) Contracts. If the Contract is a Stipulated Price Contract, include payment for work under this Section in the total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330-Submittal Procedures

B. Submit manufacturer's catalog sheets and other Product Data on Geotextile fabric.

C. Submit sieve analysis of aggregates conforming to requirements of this Specification.

1.04 REFERENCES

A. ASTM D 4632-Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

B. Storm Water Quality Management Guidance Manual prepared by the City of Schertz and Guadalupe County.

PART 2 PRODUCTS

2.01 2.01 GEOTEXTILE FABRIC

A. Provide woven or non-woven geotextile fabric made of polypropylene, polyethylene, ethylene, or polyamide material.

B. Geotextile fabric: Minimum grab strength of 200 psi in any principal direction (ASTM D-4632) and equivalent opening size between 80 and 120.

C. Geotextile and threads: Resistant to chemical attack, mildew, and rot and is for satisfactory use in west soil and aggregate environment.

D. Representative Manufacturers: Mirafi, Inc. or equal.

2.02 COARSE AGGREGATES

A. Coarse aggregate: Crushed stone, gravel, crushed blast furnace slag, or combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings of, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall be open graded with a size of 4” to 8”

PART 3 EXECUTION

3.01 PREPARATION AND INSTALLATION

A. Provide stabilized construction roads and exits at construction, staging, parking, storage, and disposal areas to keep street clean of mud carried by construction vehicles and equipment. Construct erosion and sediment controls in accordance with Drawings and Specification requirements.

B. Do not clear grub or rough cut until erosion and sediment control systems are in place, unless approved by Public Works to allow soil testing and surveying.

C. Maintain existing construction site erosion and sediment control systems until acceptance of the Work or until removal of existing systems is approved by Public Works.

D. Regularly inspect, repair or replace components of stabilized construction exits. Unless otherwise directed, maintain stabilized construction roads and exits until the City accepts the Work. Remove stabilized construction roads and exits promptly when directed by Public Works. Discard removed materials off-site.

E. Remove and dispose of sediment deposits at designated spoil site for Project. If a spoil site is not designated on Drawings, dispose of sediment off-site at a location not in or adjacent to stream or flood plain. Assume responsibility for off-site disposal.

F. Spread compacted and stabilized sediment evenly throughout site. Do not allow sediment to flush into streams or drainage ways. Dispose of contaminated sediment in accordance with existing federal, state, and local rules and regulations.

G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sediment control systems caused by construction traffic.

H. Conduct construction operations in conformance with erosion control requirements of Specification 01570 – Storm Water Pollution Control.

3.02 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits and truck washing areas, when approved by Public Works, of sizes and at locations shown on Drawings or as specified in this Section.

C. Clean tires to remove sediment on vehicles leaving construction areas prior to entering public right-of-ways. Construct truck washing areas needed to remove sediment. Wash trucks on stabilized areas that drain into drainage systems protected by erosion and sediment control measures.

D. Details for stabilized construction exits are shown on Drawings. Construct other stabilized areas to same requirements. Maintain minimum roadway widths of 14 feet for one-way traffic and 20 feet for two-way traffic and of sufficient width to allow ingress and egress. Place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Limit exposure of geotextile fabric to elements between laydown and cover to a maximum 14 days to minimize potential damage.

E. Grade roads and parking areas to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar materials to prevent sediment from entering public right-of-ways, receiving streams or storm water conveyance systems.

F. Inspect and maintain stabilized areas daily. Provide periodic top dressing with additional coarse aggregates to maintain required depth. Repair and clean out damaged control systems used to trap sediment. Immediately remove spilled, dropped, washed, or tracked sediment from public right-

of-ways.

G. Maintain lengths of stabilized areas as shown on Drawings or a minimum of 50 feet. Maintain a minimum thickness of 8 inches. Maintain minimum widths at all points of ingress or egress.

H. Stabilize other areas with the same thickness, and width of coarse aggregate required for stabilized construction exits, except where shown otherwise on Drawings.

I. Stabilized areas may be widened or lengthened to accommodate truck washing areas when authorized by Public Works.

J. Clean street daily before end of workday. When excess sediments have tracked onto streets, Public Works may direct Contractor to clean street as often as necessary. Remove and legally dispose of sediments.

K. Use other erosion and sediment control measures to prevent sediment runoff during rain periods and non-working hours and when storm discharges are expected.

END OF SECTION

SECTION 01576

WASTE MATERIAL DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.02 1.02 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Obtain a copy of approved “Floodplain Development Permit” prior to disposal of excess material in areas designated as being in “100-year Flood Hazard Area” within the City. Contact the City of Schertz Flood Plain Manager, 10 Commercial Place at (210) 619-1800 for flood plain information.

C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.

D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to project. Submit written and signed release from property owner upon completion of disposal work.

E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in Project’s Storm Water Pollution Prevention Plan (SWPPP). Refer to Section 01410-TPDES Requirements.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or

other base and surfacing material designated for salvage into City trucks.

C. Pipe Culvert: Load culverts designated for salvage into City trucks.

D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

E. Coordinate loading of salvageable material on City trucks with Public Works.

3.02 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 D above.

C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless “Floodplain Development Permit” has been obtained. Remove excess material placed in "100-year Flood Hazard Area" within the City, without “Floodplain Development Permit”, at no additional cost to the City.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

END OF SECTION

SECTION 01578

CONTROL OF GROUND AND SURFACE WATER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.

B. Protecting work against surface runoff and rising floodwaters.

C. Trapping suspended sediment in the discharge form the surface and ground water control systems.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

1. Measurement for control of ground water, if included in Bid Form, will be on either a lump sum basis or a linear foot basis for continuous installations of wellpoints, eductor wells, or deep wells.

2. Measurement for control of ground water, if included in Bid Form as an allowance, will be paid on a time and material basis. Contractor to supply detailed billing backup with invoicing.

3. If not included in Bid Proposal, include the cost to control ground water in unit price for work requiring such controls.

4. No separate payment will be made for control of surface water. Include cost to control surface water in unit price for work requiring controls.

5. Follow Section 01270 - Payment Procedures for unit price procedures.

B. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this section in the total Stipulated Price.

1.03 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3)

B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation,

Occupational Safety and Health Administration (OSHA).

1.04 DEFINITIONS

A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.

1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.

2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage: includes keeping excavations free of surface and seepage water.

C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.

D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

1.05 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.

B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Section 02260 - Trench Safety Systems, to produce following results:

1. Effectively reduce hydrostatic pressure affecting:

a. Excavations
b. Tunnel excavation, face stability or seepage into tunnels

2. Develop substantially dry and stable subgrade for subsequent construction operations

3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work

4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata

5. Maintain stability of sides and bottom of excavations

C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.

H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.

I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittals Procedures.

B. Submit Ground Water and Surface Water Control Plan for review by Public Works prior to start of excavation work. Include the following:

1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control

2. Names of equipment Suppliers and installation Subcontractors

3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures

4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics

5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations

6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.

7. Operating requirements, including piezometric control elevations for dewatering and depressurization

8. Excavation drainage methods including typical drainage layers, sump pump application and other means

9. Surface water control and drainage installations

10. Proposed methods and locations for disposing of removed water

C. Submit following records upon completion of initial installation:

1. Installation and development reports for well points, eductors, and deep wells

2. Installation reports and baseline readings for piezometers and monitoring wells.

3. Baseline analytical test data of water from monitoring wells

4. Initial flow rates

D. Submit the following records weekly during control of ground and surface water operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.

2. Maintenance records for ground water control installations, piezometers and monitoring wells

1.07 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.

D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Public Works through submittals required in Paragraph 1.06, Submittals.

B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate eductors, well points, or deep wells, when needed

C. Maintain equipment in good repair and operating condition.

D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.

1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 3 EXECUTION

3.01 GROUND WATER CONTROL

A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan. submittal

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Public Works in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.

D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.

F Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.

G. Removal of ground water control installations.

1. Remove pumping system components and piping when ground water control is no longer required.

2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.

3. Remove monitoring wells when directed by Public Works.

4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement-stabilized sand until at least 48 hour after placement.

I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.

J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.

K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.

L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.

M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

3.02 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. For aboveground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.

B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation.

Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.

C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.

D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.

E. Replace installations that produce noticeable amounts of sediments after development.

F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.06B.

3.03 SEDIMENT TRAPS

A. Install sediment tank as shown on approved plan.

B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

3.04 SEDIMENT SUMP PIT

A. Install sediment sump pits as shown on approved plan.

B. Construct standpipe by perforating 12 inch to 24 inch diameter corrugated metal or PVC pipe.

C. Extend standpipe 12 inches to 18 inches above lip of pit.

D. Convey discharge of water pumped from standpipe to sediment trapping device.

E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

3.05 EXCAVATION DRAINAGE

A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric,

and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

3.06 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations

D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Public Works.

3.07 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or educator header used in dewatering system. Also, monitor and record water level and ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Public Works determines more frequent monitoring and recording are required. Comply with Public Work’s direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

3.08 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION

SECTION 01580

PROJECT IDENTIFICATION SIGNS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign description.

B. Project sign installation.

C. Maintenance and removal of Project sign.

1.02 SYSTEM DESCRIPTION

A. Sign Construction: Construct signs of new materials in accordance with Standard Detail provided at the Pre-construction Conference.

B. Appearance: Maintain signs to present a clean and neat look throughout Contract duration.

C. Sign Manufacturer: Experienced professional sign company.

D. Sign Placement: At locations shown in Drawings unless otherwise specified by Public Works at pre-construction meeting.

1. Provide one sign at each end of a linear Project involving bridges, paving, overlay, sewer line, storm drainage, or water main construction located in rights-of-ways.

2. Provide one sign for site or building construction Contracts.

3. Provide one sign at each site for Contracts with multiple sites.

4. Sign Relocation: As work progresses, relocate signs if directed by Public Works in writing. Include cost for one relocation of post-mounted signs in Contract Price. Subsequent relocations, if directed by Public Works in writing, will be subject to Change Order.

E. Skid-mounted signs: Use for projects with noncontiguous locations where work progresses from one location to another. Design skid structure to withstand a 60 mile-per-hour wind load to the face or back of sign using stakes, straps, or ballast. Contractor shall be responsible for security of signs at each site.

1.03 SUBMITTALS

A. Submit Shop Drawings under provisions of Section 01330-Submittal Procedures.

B. Show content, layout, lettering style, lettering size, and colors. Make sign and lettering to scale, clearly indicating condensed lettering, if used.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: Use new sign materials.

1. Sign Posts: 4 inch by 4 inch pressure treated wood posts, 9 feet long for skid mounting and 12 feet long minimum for in-ground mounting.

2. Skid Bracing: 2 inch by 4 inch wood framing material.

3. Skid Members: 2 inch by 6 inch wood framing material.

4. Fasteners:

a. Galvanized steel
b. Attach sign to posts with ½ inch by 5 ½ inch button head carriage bolts and secure with nuts and flat head washers.
c. Cover button heads with white reflective film or paint to match sign background.
d. Use metal brackets and braces and ¾ inch wood screws to attach sign header.

B. Sign and Sign Header: ¾ inch thick marine plywood. Use 4 foot by 8 foot sheet for the sign and a single piece for the header to minimize joints. Do not piece wood sheets to fabricate sign face.

C. Paint and Primers: White industrial grade, fast-drying, oil-based paint with gloss finish for structural and framing members, sign, and sign header material surfaces. Paint all sign surfaces prior to adding adhesive applications.

D. Colors:

1. Sign Background: Reflective white 3M Scotchlite Engineer Grade, Pressure Sensitive Sheeting (White), or approved equal.

2. Sign Film: 3M Scotchcal Pressure Sensitive Films, or approved equal for legends, symbols, lettering and artwork. Match colors to 3M Scotchcal Pressure Sensitive Films. See Attachment 1.

2.02 SIGN LAYOUT

A. Lettering:

1. Style, Size and Spacing: Helvetica Regular Lettering.

2. Condensed Style: Text may be condensed if needed to maintain sign composition.

B. Composition:

1. See Attachment 1 for sign template.

2. Lines with Standard Text
Obtain necessary information from plans and Public Works.

a. List the Project Name, and Cost, and Funding
b. List the names of the OWNER's, Mayor, Manager, Council Members, ENGINEER and CONTRACTOR

3. Schertz LOGO

a. In colors as provided by Public Works

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Project identification signs within seven days after Date of Commencement of the Work.

B. Erect signs at locations shown in Drawings unless otherwise designated by Public Works at pre-construction meeting. Position sign so it is fully visible and readable to general public.

C. Erect sign level and plumb.

D. If mounted on posts, sink posts 3 to 4 feet below grade and stabilize posts to minimize lateral motion. Leave a minimum of 8 feet of post above existing grade for mounting of sign.

E. Erect sign so that top edge of sign is at a nominal 8 feet above existing grade.

3.01 MAINTENANCE AND REMOVAL

A. Keep signs and supports clean. Repair deterioration and damage.

B. Remove signs, framing, supports, and foundations to a depth of at least 2 feet upon completion of Project. Restore area to a condition equal to or better than before construction.

END OF SECTION

APPENDIX A TO SECTION 01580



SECTION 01581

EXCAVATION IN PUBLIC WAY PERMIT SIGNS (When Required)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project sign installation.

B. Maintenance and removal of Project sign.

1.02 SYSTEM DESCRIPTION

A. Sign Construction: Construct signs of new materials.

B. Appearance: Maintain signs to present a clean and neat look throughout the Contract duration.

C. Sign Placement: Place signs at each street entrance to street cut excavation.

1.03 SUBMITTALS

A. Submit Shop Drawings under provisions of Section 01330-Submittal Procedures.

B. Show content, layout, lettering styles, lettering size and colors. Make sign and lettering to scale, clearly indicating condensed lettering, if used.

PART 2 PRODUCTS

2.01 SIGN LAYOUT

A. Conform to Texas Manual on Uniform Traffic Control Devices. Minimum size: 36 inches by 36 inches.

B. Lettering: Uppercase Helvetica Regular lettering.

C. Composition: include a sign copy of street cut permit, title “City of Schertz”, contracting department’s name, address, and emergency telephone number and Contractor’s name. Public Works will provide department name, address, and emergency telephone number for preparation of sign.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Project signs before commencement of pavement excavation in Public Way.

B. Position sign so it is fully visible and readable to general public.

C. Erect sign level and plumb.

D. Erect sign so that top edge of sign is at a nominal 8 feet above existing grade.

3.02 MAINTENANCE AND REMOVAL

A. Keep signs and supports clean. Repair deterioration and damage.

B. Remove signs, framing, supports and foundations to depth of at least 2 feet upon completion of the Work. Restore area to condition equal to or better than before construction.

END OF SECTION

SECTION 01610

BASIC PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for transportation, delivery, handling, and storage of Products.

1.02 PRODUCTS

A. Products: Defined in General Conditions. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components designated for reuse.

B. Do not reuse materials and equipment, designated for removal, except as specified by the Contract.

C. Provide Products from the fewest number of manufacturers as practical, in order to simplify spare parts inventory and to allow for maximum interchangeability of components. For multiple components of the same size, type or application, use the same make and model of component throughout the Work.

1.03 TRANSPORTATION

A. Make arrangements for transportation, delivery, and handling of Products required for timely completion of the Work.

B. Transport and handle Products in accordance with manufacturer's instructions.

C. Consign and address shipping documents to proper party giving name of the Project and its complete street address. Shipments shall be delivered to Contractor.

1.04 DELIVERY

A. Arrange deliveries of Products to accommodate short-term site completion schedules and in ample time to facilitate inspection prior to Installation. Avoid deliveries that cause lengthy storage or overburden of limited storage space.

B. Coordinate deliveries to avoid conflict with the Work and conditions at the site and to accommodate the following:

1. Work of other contractors or the City.

2. Limitations of storage space.

3. Availability of equipment and personnel for handling Products.

4. The City's use of premises.

C. Have Products delivered to the site in manufacturer's original, unopened, labeled containers.

D. Immediately upon delivery, inspect shipment to assure:

1. Product complies with requirements of the Contract.

2. Quantities are correct.

3. Containers and packages are intact; labels are legible.

4. Products are properly protected and undamaged.

1.05 PRODUCT HANDLING

A. Coordinate off-loading of Products delivered to the site. If necessary during construction, move and relocate stored Products at no additional cost to the City.

B. Provide equipment and personnel necessary to handle Products, including those provided by the City, by methods to prevent damage to Products or packaging.

C. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging Products or surrounding areas.

D. Handle Products by methods to prevent over-bending or overstressing.

E. Lift heavy components only at designated lifting points.

F. Handle Products in accordance with manufacturer's recommendations.

G. Do not drop, roll or skid Products off delivery vehicles. Hand-carry or use suitable materials handling equipment.

1.06 STORAGE OF PRODUCTS

A. Store and protect Products in accordance with manufacturer's recommendations and requirements of these Specifications.

B. Make necessary provisions for safe storage of Products. Place Products so as to prevent damage to any part of the Work or existing facilities and to maintain free access at all times to all parts of the Work and to utility service company installations in the vicinity of the Work. Keep Products neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage in a manner so as to provide easy access for inspection.

C. Restrict storage to areas available on the site for storage of Products as shown on Drawings or approved by Public Works.

D. Provide off-site storage and protection when on-site storage is not adequate. Provide addresses of, and access to, off-site storage locations for inspection by Public Works.

E. Do not use lawns, grass plots, or other private property for storage purposes without written permission of owner or other person in possession or control of premises.

F. Protect stored Products against loss or damage.

G. Store in manufacturers' unopened containers.

H. Neatly, safely, and compactly stack Products delivered and stored along the line of the Work to avoid inconvenience and damage to property owners and general public, and maintain at least 3 feet clearance around fire hydrants. Keep public, private driveways and street crossing open.

I. Repair or replace damaged lawns, sidewalks, streets, or other improvements at satisfaction of Public Works. Total length the Products may be distributed along route of construction at one time is 1000 linear feet, unless otherwise approved in writing by Public Works.

PART 2 PRODUCTS

PART 3 EXECUTION

END OF SECTION

SECTION 01630

PRODUCT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Options for making Product or process selections.

B. Procedures for proposed equivalent Products or processes, including pre-approved, pre-qualified, and approved Products or processes.

1.02 DEFINITIONS

A. Product: As defined in General Conditions. Product does not include machinery and equipment used for production, fabrication, conveying, and erection of the Work. Products may also include existing materials or components designated for reuse.

B. Process: Any proprietary system or method for installing system components resulting in an integral, functioning part of the Work. For this Section, the word Products includes Processes.

1.03 SELECTION OPTIONS

A. Pre-approved Products: Construction products of certain manufacturers or Suppliers designated in Specification as “pre-approved.” The City maintains a list of pre-approved products. Pre-approved Products for this Project are designated as pre-approved in Specifications. Products of other manufacturers or suppliers are not acceptable for this Project and will not be considered under the submittal process for approving alternate products.

B. Pre-qualified Products: Construction products of certain manufacturers or Suppliers designated in Specifications as “pre-qualified.” Pre-qualified Products for this Project are designated as pre-qualified in Specifications. Products of other manufacturers or suppliers are not acceptable for this Project and will not be considered under the submittal process for approving alternate products.

C. Approved Products: Construction products of certain manufacturers or Suppliers designated in Specifications followed by words “or approved equal.” Approval of alternate products not listed in Specifications may be obtained through provisions for product options and substitutions in General Conditions, and by following submittal procedures specified in Section

01330-Submittal Procedures. The procedures for approval of alternate products are not applicable to pre-approved or pre-qualified products.

D. Product Compatibility: To the maximum extent possible, provide Products that are of the same type or function from a single manufacturer, make, or source. Where more than one choice is available, select Product that is compatible with other Products already selected, specified, or in use by the City.

1.04 CONTRACTOR'S RESPONSIBILITY

A. Responsibility related to Product options and substitutions is defined in General Conditions.

B. Furnish information Public Works deems necessary to judge equivalency of alternate Product.

C. Pay for laboratory testing, as well as any other review or examination cost, needed to establish equivalency between products in order to obtain information upon which Public Works can base a decision.

D. If Public Works determines alternate product is not equal to that named in Specifications, furnish one of the specified Products.

1.05 CITY REVIEW

A. Use alternate Products only when approved in writing by Public Works. Public Works determination regarding acceptance of proposed alternate Product is final.

B. Alternate Products shall be accepted if Products are judged by Public Works to be equivalent to specified Product or to offer substantial benefit to the City.

C. The City retains the right to accept any Product deemed advantageous to the City, and similarly, to reject any product deemed not beneficial to the City.

1.06 SUBSTITUTION PROCEDURE

A. Collect and assemble technical information applicable to the proposed Product to aid in determining equivalency as related to the approved Product specified.

B. Submit a written request for a construction Product to be considered as an alternate Product.

C. Submit Product information after the effective date of the Contract and within the time period allowed for substitution submittals given in General Conditions. After the submittal period has expired, requests for alternate Products shall be considered only when specified Product becomes unavailable because of conditions beyond Contractor's control.

D. Submit (5) five copies of each request for alternate Product approval. Include the following information:

1. Complete data substantiating compliance of proposed substitution with the Contract.

2. For Products:

   a. Product identification, including manufacturer's name and address.
   b. Manufacturer's literature with Product description, performance and test data, and reference standards.
   c. Samples, as applicable
   d. Name and address of similar projects on which Product was used and date of installation. Include names of Owner, design consultant, and installing contractor.

3. For construction methods:

   a. Detailed description of proposed method.
   b. Drawings illustrating methods.

4. Itemized comparison of proposed substitution with Product or method specified.

5. Data relating to changes in Construction Schedule.

6. Relation to separate contracts, if any.

7. Accurate cost data on proposed substitution in comparison with Product or method specified.

8. Other information requested by Public Works.

E. Approved alternate Products will be subject to the same review process as the specified Product would have been for Shop Drawings, Product Data, and Samples.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01725

FIELD SURVEYING

PART 1 GENERAL

1.01 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors. Employ a surveyor acceptable to Public Works if required by the Contract.

1.02 SUBMITTALS

A. Conform to requirements of Section 01330-Submittal Procedures.

B. Submit name, address, and telephone numbers of Surveyor to Public Works before starting survey work.

C. Submit documentation verifying accuracy of survey work on request.

D. Submit certificate signed by Surveyor, that elevations and locations of the Work are in conformance with the Contract.

1.03 PROJECT RECORD DOCUMENTS.

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Prepare a certified survey setting forth dimensions, locations, angels, and elevations of construction and site work upon completion of foundation walls and major site improvements.

C. Submit record documents under provisions of Section 01785-Project Record Documents.

1.04 EXAMINATION

A. Verify locations of survey control points prior to starting the Work.

B. Notify Public Works immediately if any discrepancies are discovered.

1.05 SURVEY REFERENCE POINTS

A. The City will establish survey control datum as provided in General Conditions and as indicated on Drawings. Inform Public Works in advance of time horizontal and vertical control points will be established so

verification deemed necessary by Public Works may be done with minimum inconvenience to the City or Contractor.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify Public Works a minimum of 48 hours before relocation of reference points is needed due to changes in grades or other reasons.

D. Promptly report loss or destruction of reference points to Public Works.

E. Reimburse the City of cost of reestablishment of permanent reference points disturbed by construction operations.

1.06 SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices.

B. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record horizontal and vertical location data on Project record documents.

C. Establish elevations, lines and levels to provide quantities required for measurement and payment and for appropriate controls for the Work. Locate and lay out the following with appropriate instruments:

1. Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs.

2. Grid or axis for structures.

3. Building foundation, column locations, and ground floor elevations.

D. Periodically verify layouts.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

SECTION 01731

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cutting, patching and fitting of the Work or work under construction. Coordinating Installation or connection of the Work to existing facilities, or uncovering work for access, inspection or testing and related submittals.

1.02 CUTTING AND PATCHING

A. Perform activities to avoid interference with facility operations and work of others in accordance with General Conditions of Contract.

B. Execute cutting and patching, including excavation, backfill and fitting to:

1. Remove and replace defective work or work not conforming to Drawings and Specifications;

2. Take samples of installed work as required for testing;

3. Remove construction required to provide for specified alterations or additions to existing work.

4. Uncover work to allow inspection or re-inspection by Public Works or regulatory agencies having jurisdiction.

5. Connect uninstalled work to completed work in proper sequence;

6. Remove or relocate existing utilities and pipes that obstruct work;

7. Make connections or alterations to existing or new facilities;

8. Provide openings, channels, chases and flues and cut, patch, and finish, if required; or

9. Provide protection for other portions of the Work.

C. Restore existing work to a condition equal to or better than that which existed prior to cutting and patching, and to standards required by Specifications.

D. Support, anchor, attach, match, trim and seal materials to work of others. Unless otherwise specified. Furnish and Install sleeves, inserts, and hangers required for excavation of the Work.

E. Provide shoring, bracing and support necessary to maintain structural integrity and to protect adjacent work from damage during cutting and patching. Request written approval from Public Works, before cutting structural members such as beams, anchors, lintels, or other supports. Follow approved submittals, as applicable.

F. Match new materials to existing materials by bonding, lapping, mechanically tying, anchoring or other effective means in order to prevent cracks and to minimize evidence of patching. Conceal effects of demolition and patching by blending new construction to existing surfaces. Avoid obvious breaks, joints, or changes of surface appearance unless shown on Drawings or authorized by Public Works.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330-Submittal Procedures.

B. Submit a written request to Public Works for consent to proceed, before conducting cutting operations that might affect structural integrity, design function, City operations, or work of another contractor.

C. Include the following in submittal:

1. Identification of Project

2. Description of affected work

3. Necessity for cutting

4. Effect on other work and on structural integrity

5. Describe the proposed work including:

   a. Scope of cutting and patching
   b. Contractor, Subcontractor or Supplier who will execute the work
   c. Proposed Products
   d. Extent of refinishing
   e. Schedule of operations

6. Alternatives to cutting and patching

D. When work conditions or schedule dictate the need for change of materials or methods, submit a written recommendation to Public Works that includes:

1. Conditions necessitating the change;

2. Recommendations for alternative materials or methods; and

3. Submittals required for proposed substitutions.

E. Notify Public Works in writing when work will be uncovered for observation. Do not begin cutting or patching operations until authorized by Public Works.

1.04 CONNECTIONS TO EXISTING FACILITIES

A. Perform construction operations necessary to complete connections and tie-ins to existing facilities. Keep existing facilities in continuous operation unless otherwise permitted in the Specifications or approved in writing by Public Works.

B. Coordinate interruption of service requiring connection to existing facilities with Public Works. Do not bypass wastewater or sludge to waterways. Provide temporary pumping facilities to handle wastewater if necessary. Use temporary bulkheads to minimize disruption. Provide temporary power and piping to facilitate construction where necessary.

C. Submit a detailed schedule of proposed connections, including shut-downs and tie-ins. Include proposed time and date as well as anticipated duration of work. Coordinate the connection schedule with the construction schedule.

1. Submit specific times and dates to Public Works at least 48 hours in advance of proposed work.

D. Procedures and Operations:

1. Operate existing pumps, valves, and gates in required sequence under supervision of Public Works. Do not operate valves, gates or other items of equipment without Public Works knowledge.

2. If possible, test equipment under operating conditions before making final tie-ins to connect equipment to existing facilities.

3. Coordinate work and schedules. Notify Public Works at least 48 hours before shutdowns or bypasses are required.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

SECTION 01732

PROCEDURE FOR WATER VALVE ASSISTANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operation of valves. City employees will operate existing valves. Contractor's employees may operate new valves included in the Project prior to acceptance by the City.

1.02 PROCEDURE

A. Perform activities listed in Exhibit A attached to this Section.

1.03 SUBMITTALS

A. Submit request for work order planning meetings in accordance with Exhibit A. Include information listed in Step 1 of Exhibit A, attached to this Section.

1.04 CANCELLATION

1. Contractor, Public Works, or Public Utilities Division may cancel a scheduled valve assistance appointment at no extra cost or payment to Contractor. Contractor shall notify City's appointed Project Inspector ("Inspector") 24 hours in advance of cancellation. Inspector shall notify Public Works immediately upon receipt of cancellation notice. Cancellation may be caused by bad weather, preparation of work taking longer than anticipated, or unforeseen delays in one or more of the three parties.

PART 2 PRODUCTS

PART 3 EXECUTION

END OF SECTION

EXHIBIT A

PROCEDURE FOR VALVE ASSISTANCE

The following procedure will be used by Public Works personnel when completing a service request from individual Contractors, through Inspector, for operation of existing water valves.

ROUTINE VALVE ASSISTANCE REQUEST (NON-EMERGENCY JOBS):

Step 1. a. When notified by Contractor, Inspector will schedule a work order planning meeting by calling Public Works (PW) and providing information shown below. The work order planning meeting shall be conducted a minimum of three days after the request; excluding weekends, holidays, inclement weather days, and the day of the call.

Location of Work (Street Intersection)	Project #
Project Description	Contractor (Company Name)
Job Superintendent's Name	Superintendent's Office #/Mobile #/Pager #
Contractor's Emergency Information	Name and Phone #/Mobile #/Pager #
Inspector/Senior Inspector	Name, Phone #/Mobile #/Pager #
Date & Time assistance is requested	

b. PW will create a work order for each wet connection, cut and plug, etc. that will be designated as a "Code 40" (Private Contractor).

c. PW will give Inspector the work order number. This work order number must be used as a reference in all communications regarding this request for Valve Assistance.

d. Valve personnel must have the work order number on their route sheet. When valve personnel arrive at the job site for the Work Order Planning Meeting between Inspector, Contractor, and PW valve personnel, they will verify the street intersection and work order number with the Inspector before beginning Work Order Planning Meeting.

e. During Work Order Planning Meeting, the work to be performed will be outlined and the actual date work will be performed will be mutually determined by Inspector, Contractor and PW valve personnel, based upon relevant factors such as preparatory work needed, customer requirements, etc.

f. Valve personnel will perform work specifically outlined in the work order requested. Also, PW valve personnel will only operate existing water valves. Inspector must contact PW and request a new work order for additional work.

g. Valve personnel will contact the dispatcher and advise when the job is complete. Valve personnel will list all appropriate information on the Crew Activity Report.

Step 2. Should valve personnel not be able to keep an appointment to provide valve assistance, PW will provide notification to appropriate Inspector by phone at least 24 hours prior, with that fact and rescheduling information, if available.

Step 3. Inspector will notify PW if valve personnel have not arrived at the site within 30 minutes of scheduled appointment. If Contractor is not ready when valve operator arrives to provide valve assistance, the City shall charge Contractor $50.00 per hour, starting 15 minutes after the scheduled appointment time, minimum one hour charge.

Step 4. Contractor will not be due delay claims or downtime if Utility Maintenance Branch has notified Inspector that they will not be able to provide valve assistance as scheduled.

Step 5. Test installed new valves in the presence of Inspector before substantial completion inspection is scheduled. Place new valves in open position on or before the Date of Substantial Completion.

Step 6. Public Works will notify, in writing, Utility Maintenance Branch two months before the warranty expires to report any problems they have with new water lines. Public Works will notify Contractor about these problems.

EMERGENCY REQUEST FOR VALVE ASSISTANCE PROCEDURE:

Step 1. When notified by Contractor, Inspector will request emergency Valve Assistance due to a broken line/service, etc. by calling PW and providing the following information:

Location of Work (Street Intersection)	Project #
Project Description	Superintendent's Office #/Mobile #/Pager #
Contractor (Company Name)	Name and Phone #/Mobile #/Pager #
Job Superintendent's Name	Name, Phone #/Mobile #/Pager #
Contractor's Emergency Information	
Inspector/Senior Inspector	
Date & Time assistance is requested	

Step 2. PW will create an emergency work order number and describe the work to be performed.

Step 3. PW will give Inspector the emergency work order number. Reference work order number in all communications regarding request for Valve Assistance.

Step 4. PW will contact designated valve personnel and assign emergency work order. Dispatcher will follow standard PW procedures if this situation occurs after normal working hours.

Step 5. Valve personnel must have the emergency work order number on the route sheet. When valve personnel arrive at the job site for emergency work, they will verify the street intersection and emergency work order number with Inspector prior to beginning work requested for operating existing water valves. Valve personnel will coordinate verification of street intersection and work order number with Inspector prior to performing work.

SECTION 01740

SITE RESTORATION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for restoration of Project site disturbed by utility construction operations is on a linear foot basis. Measurement will be as provided for corresponding utility in each Specification section. No separate payment made for branch pipe, valves and, other associated work for utilities. Measurement for restoration with multiple utilities within the same right-of-way will be on a linear foot basis for only one utility.

2. No separate payment made for facility or roadway projects. Include cost in the surface improvements associated with the facility or roadway construction.

3. Payment includes required site restoration within the right-of-way or easement regardless of size or type of pipe, method of construction, paved or unpaved areas or thickness and width of pavement.

4. No separate payment made for site restoration for service connections under this Section. Include cost in appropriate utility section.

5. Refer to Section 01270 - Measurement and Payment for Unit Price procedures.

B. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this section in total Stipulated Price.

1.03 DEFINITIONS

A. Phase: Locations identified on the plans and listed in Section 1110 - Summary of Work under Work Sequence.

B. Site Restoration: Replacement or reconstruction of Site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.

C. Site Improvement: Includes pavement, curbs and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Schedule of testing, service connections, abandonment, backfill, and site restoration.

C. Sample of notices to residents outlining their responsibility for maintenance of site improvements adjacent to the Project that are not disturbed by construction operations

1.05 SCHEDULING

A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of pipe laying work or paving within each block or line segment.

B. Phased Construction:

1. Commencement of subsequent Phase will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two Phases of the project.

C. Construction of Projects with no Phases listed in Section 01110- Summary of Work:

1. Complete site restoration prior to disturbing over 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way or easement.

2. Limit work to a maximum of 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way and easement. Commence work in additional right-of-way or easement after completion of site restoration.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pavement, Sidewalks and Driveways: Materials specified in Section 02951-Pavement Repair and Resurfacing.

B. Seeding and Sodding: Sod specified in Section 02922-Sodding and Seed specified in Section 02921-Hydromulch Seeding.

C. Trees, Shrubs and Plantings: Conform to requirements of Section 01562-Tree and Plant Protection.

PART 3 EXECUTION

3.01 PREPARATORY WORK

A. Provide cleanup and restoration crews to work closely behind pipe laying and roadway construction crews, and where necessary, during testing, service restoration, abandonment, backfill and surface restoration.

B. Water Lines: Unless otherwise approved by Public Works, comply with the following:

1. Once Public Works approves work within a Phase, immediately begin preparatory work for disinfection effort.

2. No later than three days after completing disinfection preparatory work, submit to City appropriate request for disinfection.

3. If City fails to perform initial disinfection of lines in accordance with Section 2514 – Disinfection of Water Lines, within seven days from submission of appropriate request, and if approved by Public Works, pipe laying operations may continue beyond approved limits until the City responds.

4. Immediately after transfer of services, begin abandonment of old water lines and site restoration.

C. Wastewater Lines:

1. Once Public Works approves work within a Line Segment, immediately begin preparatory work for testing effort.

2. No later than three days after completing preparatory work for testing, initiate testing work.

3. Immediately after transfer of service connections, begin abandonment of old wastewater lines, and site restoration.

D. Street Construction and Paving Projects

1. Once Public Works approves work within a Line Segment or block, immediately begin preparatory work for testing effort.

2. No later than three days after completing preparatory work for testing, initiate testing work.

3. Immediately after testing begin site restoration.

E. Street Construction and Paving Projects

1. Once Public Works approves work within a block, immediately begin preparatory work for sidewalk construction, sodding and hydromulching and tree planting.

2. No later than seven days after completing preparatory work, initiate construction.

3.02 CLEANING

A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Section 01576 - Waste Material Disposal.

3.03 LANDSCAPING AND FENCES

A. Seeding and Sodding.

1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains pre-construction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.

2. Restore previously existing turfed areas with sod and fertilize in accordance with Section 02922 - Sodding. Sod to match existing turf.

3. Restore unpaved areas not requiring sodding with hydromulch seeding conforming to Section 02921 - Hydromulch Seeding.

B. Trees, Shrubbery and Plants.

1. Remove and replant trees, shrubs, and plants in accordance with requirements of Section 01562-Tree and Plant Protection.

C. Fence Replacement.

1. Replace removed or damaged fencing to equal or better condition than existed prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material, not damaged by the Work, may be reused.

2. Remove and dispose of damaged or substandard material.

3.04 MAINTENANCE

A. Maintain shrubs, plantings, sodded areas and seeded areas.

B. Replace shrubs, plantings and seeded or sodded areas that fail to become established.

C. Refer to Section 01562-Tree and Plant Protection, Section 02921-Hydromulch Seeding and Section 02922-Sodding for Maintenance Requirements.

END OF SECTION

SECTION 01755

STARTING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Starting systems

B. Demonstration and instructions

C. Testing, adjusting and balancing.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Public Works seven days prior to startup of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other damage-causing conditions.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision in accordance with manufacturer's instructions.

G. When specified in individual Specification sections, required manufacturer to provide an authorized representative to be present at the site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit written report indicating that equipment or system has been properly installed and is functioning correctly.

3.02 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Public Works two weeks prior to Date of Substantial Completion.

B. Utilize O&M Manuals as the basis for instruction. Review contents of manual with Public Works in detail to explain aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shootings, servicing, maintenance, and shutdown of each item of equipment at agreed upon times, at the equipment location.

D. Prepare and insert additional data in O&M Manuals when the need for additional data becomes apparent during instruction.

E. At a minimum, Contractor will demonstrate the following:

1. Products and procedures to be used in maintaining various surfaces, e.g., counter tops, toilet partitions, tile floors, and carpeting;

2. Procedures to set and maintain landscape irrigation system;

3. Procedures to set and maintain security and fire alarm systems; and

4. Procedures to set and maintain HVAC systems.

3.03 TESTING, ADJUSTING AND BALANCING

A. Contractor shall appoint, employ and pay for the service of an independent firm to perform testing, adjusting and balancing.

B. Submit reports by the independent firm to Public Works describing observations and results of tests and signifying compliance or non-compliance with specified requirements and requirements of the Contract.

END OF SECTION

SECTION 01770

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures to establish Date of Substantial Completion.

B. Closeout procedures for final submittals, O&M data, warranties, spare parts and maintenance materials.

C. Texas Department of Licensing and Regulation (TDLR) inspection for Texas Accessibility Standards (TAS) compliance.

1.02 SUBSTANTIAL COMPLETION

A. Comply with General Conditions regarding Date of Substantial Completion when Contractor considers the Work, or portion thereof designated by Public Works, to be substantially complete.

B. Insure the following items have been completed when included in the Work, prior to presenting a list of items to be inspected by Public Works for issuance of a Certificate of Substantial Completion:

1. Cutting, plugging, and abandoning of water, wastewater, and storm sewer lines, as required by Contract documents for each item;

2. Construction of, and repairs to, pavement, driveways, sidewalks, and curbs and gutters;

3. Sodding and hydromulch seeding, unless waived by Public Works in writing;

4. General clean up including pavement markings, transfer of services, successful testing and landscape;

5. Additional requirements contained in Section 01110-Summary of Work.

C. Assist Public Works with inspection of Contractor’s list of items and complete or correct the items, including items added by Public Works, within specified time period.

D. Should Public Works inspection show failure of Contractor to comply with requirements to obtain Date of Substantial Completion, including those items in Paragraph 1.02 B. of this section, Contractor shall complete or correct the items, before requesting another inspection by Public Works.

1.03 CLOSEOUT PROCEDURES

A. Comply with General Conditions regarding final completion and final payment when the Work is complete and ready for Public Works final inspection.

B. Provide Project Record Documents in accordance with Section 01785-Project Record Documents.

C. Complete or correct items on punch list, with no new items added. Address new items during warranty period.

D. The City will occupy portions of the Work as specified in other sections.

1.04 FINAL CLEANING

A. Execute final cleaning prior to final inspection

B. For facilities, clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to sanitary condition.

D. Clean or replace filters of operating equipment.

E. Clean debris from roofs, gutters, down spouts, and drainage systems.

F. Clean site, sweep paved areas, and rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and temporary construction facilities from site following final test of utilities and completion of the Work.

1.05 ADJUSTING

A. Adjust operating equipment to ensure smooth and unhindered operation. Value of this testing and adjusting is five percent of Lump Sum Price in the Schedule of Values for items being tested.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit O&M data as noted in Section 01330-Submittal Procedures.

B. Five percent of lump sum amount of each piece of equipment as indicated in Schedule of Unit Price Work or Schedule of Values will be paid after the required O&M data submittals are received and approved by Public Works.

1.07 WARRANTIES

A. Provide one original of each warranty from Subcontractors, Suppliers, and manufacturers.

B. Provide Table of Contents and assemble warranties in a 3-ring/D binder with durable plastic cover.

C. Submit warranties prior to final progress payment.

D. Warranties shall commence in accordance with the requirements in Document 00700-General Conditions.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual Specification sections.

B. Deliver to a location within the City limits as directed by Public Works. Applicable items must be delivered prior to issuance of a final Certificate for Payment.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

SECTION 01782

OPERATIONS AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal requirements for equipment and facility Operations and Maintenance (O&M) Manuals.

1.02 MEASUREMENT AND PAYMENT

A. Measurement for equipment O&M Manuals is on a lump sum basis equal to five percent of the individual equipment value contained in Schedule of Unit Prices or Schedule of Values. The lump sum amount may be included in the first Progress Payment following approval of the O&M Manuals by Public Works.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330-Submittals Procedures. Submit a list of O&M Manuals and parts manuals for equipment to be incorporated into the Work.

B. Submit documents with 8 ½ x 11 inch text pages, bound in 3 ring/ D binders with durable plastic covers.

C. Print “OPERATION AND MAINTENANCE INSTURCTIONS”, Project, name, and subject matter of binder on covers when multiple binders are required.

D. Subdivide contents with permanent page dividers, logically organized according to the Table of Contents, with tab titling clearly printed under reinforced laminated plastic tabs.

E. O&M Manual contents: Prepare a Table of Contents for each volume, with each Product or system description identified.

1. Part 1 – Directory: Listing of names, addresses, and telephone numbers of Design Consultant, Contractor, Subcontractor, and major equipment suppliers.

2. Part 2 – O&M instructions arranged by system. For each category, identify names, addresses, and telephone numbers of Subcontractors and Suppliers and include the following:

a. Significant design criteria.
b. List of equipment
c. Parts list for each component
d. Operating instructions
e. Maintenance instructions for equipment and systems
f. Maintenance instructions for special finished, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

3. Part 3 – Project documents and certificates including:

a. Shop Drawings and relevant data.
b. Air and water balance reports
c. Certificates
d. Photocopies of warranties

F. Submit two copies of O&M Manuals and parts manuals, for review, within one month prior to placing the equipment or facility in service.

G. Submit one copy of complete volumes in final form 10 days prior to final inspection. One copy with Public Works comments will be returned after final inspection. Revise content of documents based on Public Works comments prior to final submittal.

H. Revise and resubmit three final volumes within 10 days after final inspection.

1.04 EQUIPMENT O&M DATA

A. Furnish O&M Manuals, prepared by manufacturers for all equipment. Manuals must contain, as a minimum, the following:

1. Equipment functions, normal operating characteristics, and limiting conditions.

2. Assembly, Installation, alignment, adjustment, and checking instructions.

3. Operating instructions for start up, normal operation, regulation and control, normal shutdown, and emergency shutdown.

4. Detailed drawings showing the location of each maintainable part and lubrication point with detailed instructions on disassembly and reassembly of the equipment.

5. Troubleshooting guide.

6. Spare parts list, predicted life of parts subject to wear, lists of spare parts recommended to be on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.

7. Outline, cross-section, and assembly drawings with engineering data and wiring diagrams.

8. Test data and performance curves.

B. Furnish parts manuals for all equipment, prepared by the equipment manufacturer, which contain, as a minimum, the following:

1. Detailed drawings giving the location of each maintainable part.

2. Spare parts list, predicted life of parts subject to wear, lists of spare parts recommended to be on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

SECTION 01785

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Maintenance and submittal of record documents and Samples.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Maintain one record copy of documents at the site in accordance with a Article 3.4 of General Conditions.

B. Store record documents and Samples in field office, if a field office is required by the Contract, or in a secure location. Provide files, racks, and secure storage for record documents and Samples.

C. Label each document “PROJECT RECORD” in neat, large, printed letters.

D. Maintain record documents in a clean, dry, and legible condition. Do not use record documents for construction purposes. Do not use permit drawings to record Modifications to the Work.

E. Keep record documents and Samples available for inspection by Public Works.

F. Bring record documents to progress review meetings for viewing by Public Works and, if applicable, Design Consultant.

1.03 RECORDING

A. Record information legibly with red ink pen on a set of drawings stamped “Approved For Construction”, concurrently with construction progress. Maintain an instrument on site at all times for measuring elevations accurately. Do not conceal work until required information is recorded.

B. Contract Drawings and Shop Drawings: Mark each item to record completed Modifications, or when minor deviations exist, the actual construction including:

1. Measured depths of elements of foundation in relation to finish first floor datum.

2. Measured horizontal locations and elevations of Underground Facilities and appurtenances, referenced to permanent surface improvements.

3. Elevations of Underground Facilities referenced to City benchmark utilized for the Work.

4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

5. Dimensions and details of field changes.

6. Changes made by Modifications.

7. Details not on original Drawings.

8. References to related Shop Drawings and Modifications.

C. Measure fitting to fitting of water mains at the time of construction. Record lengths, top of pipe elevations, and centerline horizontal location relative to baseline and or fixed features such as curb, manhole, etc. on Drawings

D. For larger diameter water mains, mark specifications and addenda to record:

1. Manufacturer, trade name, catalog number and Supplier of each Product actually installed.

2. Changes made by Modification or field order.

3. Other matters not originally specified.

E. Annotate Shop Drawings to record changes made after review.

1.04 SUBMITTALS

A. At closeout of the Contract, deliver Project record documents to Public Works.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 02081

CAST-IN-PLACE CONCRETE MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete manholes for sanitary sewers and storm sewers, including box sewers.

B. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for manholes is on a unit price basis for each manhole installed.

2. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

C. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

D. ASTM C 923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

E. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic - Cement Grout (Non- shrink).

F. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3).

G. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe, and Fittings.

H. ASTM D 2996 - Standard Specification for Filament-wound Fiberglass (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe.

I. ASTM D 2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe.

J. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed design mix and test data for each type and strength of concrete.

C. Submit manufacturer's data and details of following items for approval:

1. Frames, grates, rings, and covers.

2. Materials to be used in fabricating drop connections.

3. Materials to be used for pipe connections at manhole walls.

4. Materials to be used for stubs and stub plugs.

5. Plugs to be used for sanitary sewer hydrostatic testing.

6. Installation instructions for forms.

PART 2 PRODUCTS

2.01 CONCRETE

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

B. Provide Class A concrete with minimum compressive strength of 4000 psi unless otherwise indicated on Drawings.

2.02 REINFORCING STEEL

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

2.03 MORTAR

A. Conform to requirements of Section 04061 - Mortar

2.04 MISCELLANEOUS METALS

A. Provide cast-iron frames, grates, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

2.05 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.06 PIPE CONNECTIONS

A. Sanitary Sewers.

1. Resilient connectors, ring waterstops, and seals at connections of wastewater pipes to pre-cast and cast-in-place manholes and junction boxes shall be watertight, flexible, resilient and non-corrosive, conforming to ASTM C 923. Metallic mechanical devices for securing the connectors, ring waterstops, and seals in place shall be Type 304 stainless steel.

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene waterstop meeting physical property requirements of ASTM C 923, such as Pres-Seal WS Series, or approved equal.

B. Storm Sewers: Use non-shrink grout for storm sewer pipe connections to concrete manholes, unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Water Lines

1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Pres-Seal, Thunderline, Link-Seals, or approved equal. See Drawings for placement of assembly in

manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16-In. wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.07 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P 201, or approved equal.

B. Provide external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

C. Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.08 CORROSION-RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes are indicated on the Drawings, provide one of the following:

1. The interior walls coated with a City approved sewer structural coating. Approved products are as followed:
- Sewpercoat 200 HS Regular: minimum ½” thickness, or approved equal

2. Precast base sections lined with PVC and fiberglass manhole sections and cone sections in accordance with Section 02083 - Fiberglass Manholes

2.09 BACKFILL MATERIALS

A. Conform to the requirements of Section 02317 - Excavation and Backfill for Utilities.

2.10 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based non-shrink grout requiring only addition of water.

B. Provide grout meeting requirements of ASTM C 1107 and having

minimum 28-day compressive strength of 7000 psi.

2.11 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3-In. or 4-In. PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament-wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.

2. Joints and Fittings: Provide epoxy- bodied fittings and join pipe to fittings with epoxy adhesive, according to pipe manufacturer's instructions.

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-Lb. flanges. Use Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B flange bolts.

4. Coating: Provide 2-component, aliphatic polyurethane coating, using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3-Mils. Provide Amershield, Tnemec 74, or approved equal. Public Works selects color from manufacturer's standard colors.

2.12 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-Lb. rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings.

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.

2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.

3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

4. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Determine if subgrade, when scarified and re-compacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density cannot be reached, moisture condition subgrade, until that density is reached or treat as an unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Public Works.

3.02 MANHOLES

A. Construct manholes to dimensions shown on Drawings. Commence construction as soon as possible after pipes are laid. On monolithic sewers, construct manholes at same time sewer is being constructed.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Public Works for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24- In. thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

C. Cast manhole foundations and walls monolithically. Use cold joint with approved waterstop when manhole flow line depth exceeds 12-Ft. No other joints will be allowed unless shown on Drawings. Wrap cold joints with external sealing material, minimum 6-In. width.

D. For concrete containing micro silica admixtures, place, finish, and cure concrete for manholes following procedures in Section 03315 – Concrete for

Utility Construction.

E. Top of manhole elevations shown on Drawings are approximate, based on current pavement and natural ground conditions as determined from elevations measured on 50-Ft. spacing. No additional payment will be made if final elevation of manhole ring and cover is higher or lower due to requirements of finished grade or replaced pavement surface.

3.03 PIPE CONNECTIONS

A. Install approved resilient connectors at each pipe entering and exiting water line and sanitary sewer manholes in accordance with manufacturer's instructions.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetrations both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other solid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on interior or exterior of manhole. When necessary, fill space with compressible material to ensure resilient connector will maintain full flexibility where evidence of reduced flexibility is encountered.

D. Where new manhole is to be constructed on existing sewer, a rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe spring line using adhesive recommended and supplied by waterstop manufacturer.

E. Do not construct joints on sanitary sewer pipe within wall sections of manholes. Use approved connection material.

F. Construct pipe stubs with resilient connectors for future connections at locations and with material indicated on Drawings. Install approved stub plugs at interior of manhole.

G. Test connection for watertight seal before backfilling.

3.04 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1-In. per foot minimum; 1 ½-In. per foot

maximum.

2. Depth of bench to invert:

a. Pipes smaller than 15-In.: one-half of largest pipe diameter

b. Pipes 15 to 24-In.: three-fourths of largest pipe diameter

c. Pipes larger than 24-In.: equal to largest pipe diameter

3. Invert slope through manhole: 0.10-Ft. drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with Class A concrete if not integral with manhole base. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.05 DROP CONNECTIONS FOR SANITARY SEWERS

A. Construct drop assembly inside manhole in accordance with City Standard Detail.

B. Install connection when sewer line enters manhole higher than 24-In. above invert of manhole.

3.06 STUBS FOR FUTURE CONNECTIONS

A. In manholes where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.07 ADJUSTMENT RINGS AND FRAME

A. Combine a minimum of 2 precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface or elevation shown in drawings. Maximum combined height of rings to be no more than 21 inches. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces to be joined with non-shrink grout. Set cast iron frame on adjustment ring in a bed of approved sealant material. Install a sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-In. and 1/2-In. wide.

B. Wrap manhole frame and adjustment rings with external sealing material,

minimum 3-In. beyond joint between ring and frame, and ring and precast section. Encase rings and frame with type B concrete, per drawings.

C. For manholes in unpaved areas, set top of frame level with encasement and existing ground line unless otherwise indicated on Drawings. Encase manhole frame with type B concrete, placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

3.08 BACKFILL

A. After concrete obtains adequate strength, place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities. Use embedment zone backfill material for adjacent utilities, as shown in City Standard Details over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to spring line of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4-In. of topsoil conforming to requirements of Section 02911 - Topsoil. Seed in accordance with Section 02921 - Hydro-mulch Seeding, or sod disturbed areas in accordance with Section 02922 - Sodding.

3.09 FIELD QUALITY CONTROL

A. Conduct leakage testing of Sanitary Sewer manholes in accordance with requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.10 PROTECTION

A. Protect manholes from damage until subsequent work has been accepted. Repair or replace damaged elements of manholes at no additional cost to the City.

END OF SECTION

SECTION 02082

PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines.

B. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for normal depth manholes, up to 6-Ft. deep, is on a unit price basis for each manhole installed. Manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes.

2. Payment for shallow depth manholes is on a unit price basis for each manhole installed. Shallow manholes have a depth of 5-Ft. or less measured from top of cover to sewer invert.

3. Payment for extra depth manholes is on a unit price basis per vertical foot for each foot of depth greater than 6-Ft. Sewer manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes.

4. Payment for normal depth corrosion resistant manholes is on a unit price basis for each manhole installed

5. Payment for standard manhole drops is on a unit price basis for each drop installed. Standard manhole drops include internal drops only.

6. Payment for watertight manholes, including vented manholes is on a unit price basis for each.

7. Payment for air-release manhole with valves and fittings installed is on a unit price basis for each manhole with air-release valves and

fittings installed.

8. Payment for pile supported concrete foundation used for unstable sub-grade treatment for manhole base is on a unit price basis for each foundation installed.

9. Pay estimates for partial payments will be made as measured above according to the following schedule for sanitary sewer manholes:

   a. Estimate for 90 percent payment will be authorized when the manhole is completely installed and surrounding soil backfilled

   b. Estimate for 100 percent payment will be authorized when manhole has been tested as specified in Section 02533 - Acceptance Testing for Sanitary Sewers

10. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings

B. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

C. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. ASTM C 270 - Standard Specification for Mortar for Unit Masonry

E. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

F. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

G. ASTM C 923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

H. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non- shrink)

I. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3)

J. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

K. ASTM D 2996 - Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe

L. ASTM D 2997 - Standard Specification for Centrifugally Cast “Fiberglass” (Glass-Fiber- Reinforced Thermosetting Resin) Pipe

M. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

N. American Association of State Highway and Transportation Officials (AASHTO)

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.

2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.

3. Frames, grates, rings, and covers

4. Materials to be used in fabricating drop connections

5. Materials to be used for pipe connections at manhole walls

6. Materials to be used for stubs and stub plugs, if required

7. Materials and procedures for corrosion-resistant liner and coatings, if required.

8. Plugs to be used for sanitary sewer hydrostatic testing

9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches

C. Seal submittal drawings by Professional Engineer registered in the State of Texas.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 5-in. Base section shall have minimum thickness of 12-In. under invert.

C. Provide tops to support HS-20 vehicle loading, and receive cast iron frame covers, as indicated on Drawings.

D. Where manholes larger than 60-In. diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 60-in. diameter manhole access riser sections. Transition is to be concentric unless otherwise shown on Drawings. Locate transition to provide minimum of 5-ft. head clearance from base to underside of transition unless otherwise approved by Public Works.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.

1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs

2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections

3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf

4. Internal liquid pressure based on unit weight of 63 pcf

5. Dead load of manhole sections fully supported by transition and base slabs.

F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:

1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.

2. Wall loading conditions:

a. Saturated soil pressure acting on empty manhole

b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure

3. Minimum clear distance between two wall penetrations shall be 12-In. or half diameter of smaller penetration, whichever is greater

G. Provide joints between sections with o-ring gaskets conforming to ASTM C 443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6-In. above inside surface of floor of base.

2.02 CONCRETE

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4000 psi.

C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings, conforming to requirements of Section 02321 - Cement

Stabilized Sand.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4000 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.03 REINFORCING STEEL

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

2.04 MORTAR

A. Conform to requirements of Section 04061 - Mortar.

2.05 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings and Covers.

2.06 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.07 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers.

1. Provide Resilient connectors, ring waterstops, and seals at connections of wastewater pipes to pre-cast and cast-in-place manholes and junction boxes shall be watertight, flexible, resilient and non-corrosive, conforming to ASTM C 923. Metallic mechanical devices for securing the connectors, ring waterstops, and seals in place shall be Type 304 stainless steel.

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

B. Storm Sewer Connections:

A. Provide watertight connections in accordance with ASTM C 923.

C. Water Lines

A. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.

B. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16-In. wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.08 SEALANT MATERIALS

A. Approved products in accordance with Section 01630 - Product Substitution Procedures.

B. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.

C. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

D. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.09 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes are indicated on Drawings, provide one of following:

1. The interior walls coated with a City approved sewer structural coating. Approved products are as followed:
   - Sewpercoat 200 HS Regular: minimum ½" thickness, or approved equal.

2. Precast base sections, as specified above, lined with PVC or equal and fiberglass manholes in accordance with Section 02083 - Fiberglass Manholes.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Section 02317 - Excavation and Backfill for

Utilities.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

2.12 VENT MANHOLES

A. Provide vented manhole lids for manholes where indicated on Drawing B.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of sanitary sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

2.14 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-Lb. rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.

2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.

3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

B. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and re-compacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Public Works.

3.02 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on Drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.03 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 6-inch thick (minimum) foundation of crushed stone, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Section 02321 - Cement Stabilized Sand.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Public Works for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-In. thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

3.04 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. To provide a watertight seal, all manhole riser joints shall be sealed with a minimum nine (9) inch wide exterior joint wrap meeting this specification and installed according to manufacturer’s recommendations.

C. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

D. Seal any lifting holes with non-shrink grout.

E. Where liners are required, seal joints between sections in accordance with manufacturer's recommendations.

3.05 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: "Press-Wedge," "Res-Seal," "Thunderline Link-Seals," or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of 9/16-In. wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

E. Test connection for watertight seal before backfilling.

3.06 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1-In. per foot minimum; 1-1/2-In. per foot maximum

2. Depth of bench to invert:

a. Pipes smaller than 15-In.: one-half of largest pipe diameter

b. Pipes 15 to 24-In.: three-fourths of largest pipe diameter

c. Pipes larger than 24-In.: equal to largest pipe diameter

3. Invert slope through manhole: 0.10-Ft. drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.07 DROP CONNECTIONS FOR SANITARY SEWERS

A. Construct drop assembly in accordance with City of Schertz Standard Detail.

B. Install drop connection when sewer line enters manhole higher than 30-In. above invert of manhole.

3.08 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.09 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine at a minimum of 2 precast concrete or HDPE adjustment rings of 2-inch thickness each so elevation of installed casting cover matches pavement surface or elevation shown in drawings. Maximum combined height of rings to be no more than 21 inches. Seal between concrete

adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-In. and 1/2-In. wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section. Encase rings and frame with type B concrete, per drawings.

C. For manholes in unpaved areas, set top of frame level with encasement and existing ground line unless otherwise indicated on Drawings. Encase manhole frame with type B concrete, placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12-In. over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4-In. of topsoil conforming to requirements of Section 02911 - Topsoil. Seed in accordance with Section 02921 - Hydromulch Seeding. When shown on Drawings, sod disturbed areas in accordance with Section 02922 - Sodding.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to the City.

END OF SECTION

SECTION 02083

FIBERGLASS MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass manholes for unpaved areas placed on top of a precast base to form a manhole.

B. Fiberglass for construction in back lot easements placed on cast-in-place base.

C. Fiberglass manholes are not permitted underneath existing or proposed pavement.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for fiberglass manholes is on unit price basis for each manhole installed.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

C. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

D. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non- shrink).

E. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 Ft.-Lb./Ft^3 (600kN-m/m^3).

F. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.

G. ASTM D 2996 - Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe.

H. ASTM D 2997 - Standard Specification for Centrifugally Cast “Fiberglass” (Glass-Fiber- Reinforced Thermosetting Resin) Pipe.

I. ASTM D 3753 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells.

J. American Association of State Highway and Transportation Officials (AASHTO).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's data and details of following items for approval:

1. Design and fabrication details of fiberglass manhole components

2. Installation instruction for fiberglass manholes

3. Frames, grates, rings, and covers

4. Materials to be used in fabricating drop connections

5. Materials to be used for pipe connections at manhole walls

6. Materials to be used for stubs and stub plugs, if required

7. Plugs to be used for sanitary sewer hydrostatic testing

8. Manufacturer's data for pre-mix (bag) concrete if used for channel inverts and benches

9. Manufacturer's color chart for fiberglass vent pipe coatings.

C. Submittals listed in Section 02082, paragraph 1.04.

PART 2 PRODUCTS

2.01 FIBERGLASS MANHOLES AND BASE SECTIONS

A. Provide prefabricated fiberglass manholes which conform in shape, size, dimensions, and details shown on Drawings. Unless modified by Drawings, use manhole sections conforming to ASTM D 3753.

B. Provide products manufactured by companies listed on the City of Schertz Standard Product List.

C. Mark date of manufacture and name or trademark of manufacturer in 1-In. high stenciled letters on inside of barrel.

D. Unless larger size is required, provide 60-inch-diameter barrel for fiberglass manholes. Provide wall section thickness for depth of manhole according to ASTM D 3753, but not less than 0.50-In. in thickness.

E. Provide fabricated reducer bonded at factory to form one continuous unit at top of manhole barrel to accept concrete grade rings and cast iron frame and cover. Reducer design shall be of sufficient strength to safely support HS-20 loading in accordance with AASHTO.

F. Provide manhole base of precast concrete conforming to Section 02082 - Precast Concrete Manholes, unless cast-in-place base is indicated on Drawings. For precast manhole bases, use an approved steel-reinforced design of sufficient strength to withstand imposed loads. Form base so that joint with fiberglass manhole barrel is sealed against leakage, as shown on Drawings.

2.02 CONCRETE

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4000 psi.

C. Concrete Foundation: Use Class A concrete with minimum compressive strength of 4000 psi for cast-in-place base and for foundation slab under manhole base section where indicated on Drawings.

D. Cement Stabilized Sand Foundation: In lieu of foundation slab, provide cement stabilized sand foundation under base section, when shown on manhole Drawings, conforming to requirements of Section 02321 - Cement Stabilized Sand.

2.03 REINFORCING STEEL

A. Provide reinforcing steel conforming to requirements of Section 03315 - Concrete for Utility Construction.

2.04 MORTAR

A. Conform to requirements of Section 04061 - Mortar.

2.05 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

2.06 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.07 PIPE CONNECTIONS FOR SANITARY SEWERS

A. Provide pipe connections conforming to requirements of Section 02082 - Precast Concrete Manholes.

B. For drop, provide manufactured connector, such as Insert-a-Tee or equal, which provides positive seal between pipe and wall.

2.08 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P201, or approved equal.

B. Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.09 BACKFILL MATERIALS

A. Backfill materials shall conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

2.10 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, nonmetallic, cement-based grout requiring only addition of water.

B. Grout shall meet requirements of ASTM C 1107 and shall have minimum 28-day compressive strength of 7000 psi.

2.11 VENT PIPES

A. Provide external vent pipes for manholes, where indicated on Drawings.

B. Buried Vent Pipes: Provide 3-In. or 4-In. PVC DWV pipe conforming to ASTM D 2655. Alternately, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament-wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations

2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive, according to pipe manufacturer's instructions.

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Flanges shall meet bolt pattern and dimensions for ANSI B16.1, 125-Lb. flanges. Flange bolts shall be hot-dip zinc coated, conforming to ASTM A307, Class A or B.

4. Coating: Provide 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3-Mils. Provide Amershield, Tnemec 74, or equal. Color shall be selected by Public Works from manufacturer's standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When it cannot be compacted to that density, moisture condition subgrade until that density can be reached or treat as an unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Public Works.

3.02 PLACEMENT

A. Install fiberglass manholes to conform to locations and dimensions shown on Drawings. Do not install underneath existing or proposed pavement.

B. Place sanitary sewer manholes at points of change of alignment, grade, size, pipe intersections, and end of sewer.

3.03 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place base section and foundation as required in Section 02082 - Precast Concrete Manholes.

3.04 CAST-IN-PLACE FOUNDATION

A. Where Drawings indicate cast-in-place manhole base, place concrete as shown on Drawings on 4-In. (minimum) layer of either crushed stone, cement stabilized sand, or seal slab. When unstable subgrade is identified, over-excavate subgrade to allow for placement of 12-In. thick layer of crushed stone wrapped in filter fabric.

3.05 MANHOLE BARREL

A. Lower manhole barrel onto base section. Seal with manufacturer's gasket or approved sealant. Wrap joint with external sealing material, minimum 12-In. width.

B. Where cast-in-place base is used, support manhole barrel in place and brace it from sides of excavation to prevent any movement of barrel during concrete placement and while concrete is setting. Provide minimum clearance between reinforcing steel and manhole barrel bottom as shown on Drawings. Do not support manhole barrel on reinforcing steel. Place bead of water swelling sealant around inside of barrel near bottom, as shown on Drawings, to form seal.

3.06 PIPE CONNECTIONS AT PRECAST MANHOLE BASE

A. Install approved resilient connectors at each pipe entering and exiting sanitary sewer manholes in accordance with manufacturer's instructions.

B. Ensure that no concrete, cement stabilized sand, fill, or other solid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. When necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

C. Test connection for watertight seal before backfilling.

3.07 PIPE CONNECTIONS AT CAST-IN PLACE BASE

A. Cut manhole barrel for pipe penetrations following curvature of pipe and with maximum of 1-In. clearance. Seal cut edges with resin. Hole may be circular or cutout with semi- circular top which extends to bottom of barrel.

B. Place continuous bead of water swelling sealant, as shown on Drawings, around pipe penetrations on interior of manhole barrel. Roughen surface of fiberglass prior to placement to improve bond with sealant. Allow sealant to completely cure before placing concrete against it.

C. Extend pipe entering manhole at least 8-In. into manhole. Fit pipes with neoprene water- stop gasket seal placed tightly around pipe using stainless steel clamp. Alternately, pipes may have continuous bead of water swelling sealant, as detailed on Drawings, placed around pipe circumference.

D. When forming invert surface in bottom of manhole, mound concrete around pipe penetrations so that water swelling sealant beads and neoprene water-stop gasket have minimum 2-In. of concrete cover.

E. Test connection for watertight seal before backfilling.

3.08 INVERTS FOR SANITARY SEWERS

A. Construct invert channels as required in Section 02082 - Precast Concrete Manholes.

3.09 DROP CONNECTIONS FOR SANITARY SEWERS

A. Construct drop connections in accordance with City of Schertz Standard Details..

B. Install drop connection when sewer line enters manhole higher than 24-In. above invert of manhole.

C. At drop pipe connections through fiberglass barrel, cut circular hole sized to requirements of manufactured connector. Seal cut edge with resin. Install watertight connector according to manufacturer's recommendations.

3.10 STUBS FOR FUTURE CONNECTIONS

A. Where future connections are indicated on Drawings, install resilient

connectors and pipe stubs with approved watertight plugs in manholes.

B. At cast-in-place base, where future connections are indicated on Drawings, install section of pipe extending no further than 12-In. from edge of foundation, ending in bell and provided with rubber-gasket watertight plug.

3.11 ADJUSTMENT RINGS AND FRAME

A. Combine precast concrete or HDPE adjustment rings so that elevation of installed casting cover matches pavement surface. Do not load manhole except on load bearing shoulder of manhole. Seal between adjustment ring and fiberglass manhole with approved sealant material. Apply a latex bonding agent to precast concrete surface and join with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads on sealant, each bead having minimum dimensions of 1/2-In. and 1/2-In. wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3-In. beyond joint between ring and frame and ring and precast section.

C. Set cast iron frame on top of cone or adjustment rings using water swelling sealant materials and adjust elevation of casting cover to match pavement surface. Encase cone and frame with concrete type B per drawings.

3.12 BACKFILL

A. After leakage testing, place and compact backfill material in area of excavation surrounding manholes in accordance with requirements of Section 02317- Excavation and Backfill for Utilities. Use embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to elevation 12-In. over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4-In. of topsoil conforming to requirements of Section 02911 - Topsoil and seed in accordance with Section 02921 - Hydromulch Seeding. When shown on Drawings, sod disturbed areas in accordance with Section 02922- Sodding.

3.13 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with

requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.14 PROTECTION

A. Protect manholes from damage until work has been finally accepted. Repair damage to manholes at no additional cost to the City.

END OF SECTION

SECTION 02084

FRAMES, GRATES, RINGS, AND COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for frames, grates, rings, covers, and seals under this Section. Include payment in unit price for related item.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges

B. ASTM A 48 - Standard Specification for Gray Iron Castings

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. AWS - D 12.1 Welding Reinforcing Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings or standard City details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 PRODUCTS

2.01 CASTINGS

A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.

B. Use clean castings capable of withstanding application of AASHTO M306- 40,000-Lb. proof loading without detrimental permanent deformation.

C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32-In. in diameter.

D. Use clean castings, free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.

2.02 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

2.03 SPECIAL FRAMES AND COVERS

A. Where indicated on Drawings, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

B. Where shown on Drawing, provide manhole frames and covers with 48-In. diameter clear opening, with inner cover for 30-In. diameter clear opening. Provide approved inner cover with pattern shown on Drawings.

2.04 FINISH

A. Unless otherwise specified, uncoated coat iron.

2.05 FABRICATED RING GRATES

A. Fabricate ring grates from reinforcing steel conforming to ASTM A 615.

B. Conform to welds connecting bars to AWS D 12.1.

2.06 ADJUSTMENT RINGS FOR ASPHALT OVERLAYS

A. Use castings conforming Section 2.01.

B. One piece casting with dimensions to fit frame and cover.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

END OF SECTION

SECTION 02085

VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Valve boxes for water service.

B. Meter boxes for water service.

C. Meter vaults for water service.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for valve boxes under this Section. Include payment in unit price for Section 02521 Gate Valves, 02522 Butterfly Valves.

2. No separate payment will be made for meter boxes under this Section. Include payment in unit price for Section 02526 Water Meters.

3. Payment for each size of meter vaults is on unit price basis per vault. Payment will be made for each vault installed, regardless of depth.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 48 - Standard Specification for Gray Iron Castings.

B. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

F. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturers' product data for following items for approval:

1. Each type of valve box and lid.

2. Each type of meter box and cover.

3. Each type of meter vault frame and cover.

C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in State of Texas.

D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.05, Plastic Meter Boxes.

PART 2 PRODUCTS

2.01 VALVE BOXES

A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.

B. Cast "WATER" into lid, ½-In. in height and raised 3/32-In., for valves serving potable water lines.

C. Unless otherwise specified, uncoated cast iron.

D. Riser Pipe.

1. 6-In. ductile-iron, thickness Class 51 riser pipes in accordance with Section 02501 – Ductile Iron Pipe and Fittings.

2. Provide single section of pipe.

E. Concrete for valve box placement:

1. Valve boxes located in streets or other area subject to vehicular traffic shall be provided with concrete collars as shown in the Standard Drawings. Collars around such valve boxes shall be formed and finished off neatly and to finish grade.

2. For other locations, provide concrete for sidewalks conforming to requirements of Section 02751 - Concrete Paving.

2.02 METER BOXES

A. Provide meter boxes for 5/8-In. through 2-In. meters of the following materials:

1. Non-traffic bearing locations: Plastic.

2. Traffic bearing locations: Cast iron.

B. Provide meter boxes for 2-In. and larger meters of cast iron.

C. Extensions: Meter box extensions 3-In. and 6-In. in height shall be available from manufacturer as standard item.

2.03 PLASTIC METER BOXES

A. Provide meter box as manufactured by DFW Plastics of Fort Worth, TX and meeting the requirements of Models D1218-RSBSM or DFW39C-SBSM. Made of black modified polyethylene conforming to the following ASTM standards:

B. Meter box lid shall have the words “Water Meter” molded into the lid, diamond pattern, 1 piece of ½” rebar secured in lid, AMR Slide Mount molded into lid on the underneath side and off center.

C. Meter box body shall have crush resistant ribbing along outside of the box and a flange around the top opening to help prevent settling and adjustment to grade.

2.04 CAST-IRON METER BOXES

A. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A 48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.

B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish. Lid edges must be free of drippings that prevent proper seating in box.

C. Lid shall be steel checkered plate rectangular cover with raised lug pattern, with 2 – 1”x1”x1/8” (23 3/4” long) angle steel and 2 – 2”x2”x1/4” (22” long) angle steel welded to underside. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.

2.05 METER VAULTS

A. Meter vaults may be constructed of precast concrete, cast-in-place concrete unless a specific type of construction is required by Drawings.

B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Section 03315 - Concrete for Utility Construction with minimum compressive strength of 4000 psi at 28 days.

C. Reinforcing steel for meter vaults: Conform to requirements of Section 03315 Concrete for Utility Construction.

D. Grates and Covers: Conform to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Obtain approval from Public Works for location of meter vault.

B. Verify lines and grade are correct.

C. Verify compacted subgrade will support loads imposed by vaults.

3.02 VALVE BOXES

A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.

1. Install with bell on top of valve

2. Place riser pipe in plumb, vertical position

B. Install valve box and riser piping plumbed in a vertical position. Provide 6-In. telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.

C. Set, align, and adjust valve box so that lid is level with final grade. Pour concrete collar, per plans.

D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by the City, repaint covers black.

3.03 METER BOXES

A. Install cast iron or plastic boxes in accordance with manufacturer's instructions.

B. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.

D. Do not locate under paved areas unless approved by Public Works. Use approved traffic- type box with steel plate lid when meter must be located in paved areas.

3.04 METER VAULTS

A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.

B. Precast Meter Vaults:

1. Install precast vaults in accordance with manufacturer's recommendations. Set level on a minimum 3-In. thick bed of sand, or compacted granular base conforming to requirements of Section 02320 - Utility Backfill Materials.

2. Seal lifting holes with cement-sand mortar or non-shrink grout.

C. Meter Vault Floor Slab:

1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor ¼-In. per foot toward sump. Make sump 6-inch minimum in diameter, or 12-In. square, and 4-In. deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18-In., center-to-center for keying walls to floor slab.

2. Precast floor slab elements may be used for precast vault construction

D. Cast-in-Place Meter Vault Walls:

1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4-In..

2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 Ft.

3. Set frame for cover in concrete

3.05 FRAME AND COVER FOR METER VAULTS

A. Vault Access Doors: Vault access doors shall be designed for H20 traffic loads in vehicle access areas or in as future paved areas. Access doors shall be aluminum in non-vehicle traffic areas. Vault access doors shall have lifting pistons.

B. Vault Access Covers: Vault covers shall be steel checkered plate, ¼" minimum thickness reinforced with steel members for the design load specified. Reinforcing shall be stagger welded to the cover, and the entire assembly shall be hot dip galvanized after fabrication. The top of the cover plate shall be flush with the vault slab. Covers and reinforcing members shall be designed to fit a preformed recess in the vault casting with steel reinforcing members mitered at each end. Cover plates shall have lifting holes.

C. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:

1. In unpaved areas, set top of meter box or meter vault cover 2 to 3-In. above natural grade

2. In paved areas, set top of meter box or meter vault cover flush

with adjacent pavement but no higher than 1/2-In.

3.06 BACKFILL

A. Provide bank run sand in accordance with Section 02320 - Utility Backfill Materials and backfill and compact in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1- to-5 slope from top to natural grade.

C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION

SECTION 02086

ADJUSTING MANHOLES, INLETS, AND VALVE BOXES TO GRADE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adjusting elevation of manholes, inlets, and valve boxes to new grades.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for adjusting inlets and valve boxes to grade for new construction under this Section. Include payment in unit price for related item.

2. Payment for adjusting existing manhole and frame and cover to new grade is on a unit price basis for each manhole and frame and cover.

3. Payment for adjusting existing utility structures to grade is on unit price basis for each inlet adjusted or valve box adjusted

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Provide concrete, conforming to requirements of Section 03315 - Concrete for Utility Construction.

B. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Section 02082 - Precast Concrete Manholes.

C. Provide mortar conforming to requirements of Section 04061 - Mortar.

2.02 CAST-IRON MATERIALS

A. Provide cast-iron materials conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

2.03 PIPING MATERIALS

A. For riser pipes and fittings, refer to Sections 02501 - Ductile-iron Pipe and Fittings through 02528 - Polyethylene Wrap.

2.04 MASONRY MATERIALS FOR STORM SEWER MANHOLES AND INLETS

A. Provide brick masonry units conforming to the requirements of Section 04210 – Brick Masonry for Utility Construction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine existing structure, valve box, frame and cover or inlet box, frame and cover or inlet, piping and connections for damage or defects affecting adjustment to grade. Report damage or defects to Public Works.

3.02 ESTABLISHING GRADE

A. Coordinate grade related items with existing grade and finished grade or paving, and relate to established bench mark or reference line.

3.03 ADJUSTING MANHOLES AND INLETS

A. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in the following Sections:

1. Section 02081 - Cast-In-Place Concrete Manholes

2. Section 02082 - Precast Concrete Manholes

3. Section 02083 - Fiberglass Manholes

4. Section 02632 - Cast-In-Place Inlets, Headwalls and Wingwalls

5. Section 02633 - Precast Concrete, Inlets, Headwalls and Wingwalls

B. Salvage and reuse cast-iron frame and cover or grate.

C. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.

D. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Project Manger's approval.

3.04 ADJUSTING VALVE BOXES

A. Salvage and reuse valve box and surrounding concrete block as approved by Project Manger. No separate pay.

B. Remove and replace 6 inch ductile iron riser pipe with suitable length for depth of cover required to establish adjusted elevation to accommodate actual finish grade.

C. Reinstall valve box and riser piping plumbed in vertical position. Provide minimum 6-In. telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box for vertical movement damping.

D. After valve box has been set, aligned, and adjusted so that top lid is level with final grade.

3.05 BACKFILL AND GRADING

A. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Section 02316 - Excavation and Backfill for Structures.

B. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.

C. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4-In. of topsoil conforming to requirements of Section 02911- Topsoil. Provide seeding in accordance with Section 02921 - Hydromulch Seeding, or if sodding in accordance with Section 02922 - Sodding.

END OF SECTION

SECTION 02221

REMOVING EXISTING PAVEMENTS AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, brick pavement and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.

C. Removing pipe culverts, sewers, and sewer leads.

D. Removing existing inlets and manholes.

E. Removing and disposing of pre-stressed concrete beams and drill shafts.

F. Removing miscellaneous structures of concrete or masonry.

G. Removing existing bridge.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for removing and disposing of asphaltic surfacing with or without base, regardless of thickness encountered, is on square yard basis measured between lips of gutters.

2. Payment for removing and disposing of reinforced concrete pavement, with or without asphalt overlay, regardless of its thickness, is on square yard basis measured from back- to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.

3. Payment for removing and disposing of flexible base or cement stabilized base course, with or without asphaltic surfacing, is on square yard basis.

4. Payment for removing and disposing of concrete sidewalks and driveways is on square yard basis.

5. Payment for removing asphaltic surface course only is on a

square yard basis paid under item description "Asphalt Surface Mill." This includes removal of existing surface to pavement base.

6. Payment for removing and disposing of miscellaneous concrete and masonry is on cubic yard basis of structure in place.

7. Payment for removing and disposing of pipe culverts, sewers, and sewer leads is on linear foot basis for each diameter and each material type of pipe removed.

8. Payment for removing and disposing of existing inlets is on unit price basis for each inlet removed.

9. Payment for removing and disposing of prestressed concrete piles and drill shafts is on linear foot basis.

10. Payment for removing and disposing of existing bridge, including piles and abutments to minimum of 4-Ft. below ground level, is on a lump sum basis.

11. Payment for removing and disposing of existing manholes is on unit price basis for each manhole removed.

12. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section. Include cost of such work in unit prices for items listed in bid form requiring saw cutting.

13. No payment will be made for work outside maximum payment limits indicated on Drawings, or for pavements or structures removed for Contractor's convenience.

    a. For utility installations: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.

14. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate removal work with utility companies.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain advance approval from Public Works for dimensions and limits of removal work.

B. Identify known utilities below grade. Stake and flag locations.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Adjacent public and private property.

2. Trees, plants, and other landscape features designated to remain.

3. Utilities designated to remain.

4. Pavement and utility structures designated to remain.

5. Bench marks, monuments, and existing structures designated to remain.

3.03 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to minimum depth of 2-In..

D. When street and driveway saw cut location is greater than one-half of pavement lane width, remove pavement for full lane width or to nearest longitudinal joint as directed by Public Works.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install 8-In. thick masonry plug in pipe end prior to backfill in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

3.04 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

3.05 DISPOSAL

A. Inlet frames, grates, and plates; and manhole frames and covers, may remain City property. Disposal shall be in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove from site, debris resulting from work under this section in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

SECTION 02222

ABANDONMENT OF SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Abandonment in place of existing sewers, junction structures, manholes, and force mains.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for grout fill and abandonment of existing sewers, including boxes and elliptical shaped sewers, is on linear foot basis for each diameter of sewer being abandoned. Measurement will be along centerline of sewer from centerline to centerline of manholes.

2. Payment for grout fill and abandonment of sewer manholes or junction structure is by each manhole or junction structure abandoned in conformance with this Section.

3. Payment will be full compensation for all material, equipment, and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, PVC pipes and incidentals.

4. No separate payment will be made for plugging and abandoning sewer force mains. Include cost of such abandonment in related work.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

6. Acceptability of grout material is based on achieving average strength within range of 75 to 150 psi as defined in Paragraph 2.01B.1. Grout that is out of range after placement may be accepted with price adjustment of 1.0 percent price deduction for each psi average compressive strength below 75 psi and 0.5 percent price deduction for each psi average compressive strength above 150 psi, as applicable to material volume represented by test series. Shrinkage in grout material placements shall be remedied by Contractor according to Paragraph 3.04H without additional compensation.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Abandonment. Sewer abandonment consists of demolition and removal of portion of manholes existing within specified depth of surface, and abandonment in place of sewer lines and manholes as specified in this Section.

B. Flowable Fill. Flowable fill (abandonment grout) shall be controlled low-strength material consisting of fluid mixture of cement, fly ash, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sewer pipes or other restricted areas, or as mass placement by chutes or tremie methods in unrestricted locations with open access. Long-term hardened strength shall be within specified range.

C. Ballast. Large aggregate either replaced with voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at same time as flowable fill placement.

D. Backgrouting. Secondary stage pressure grouting to ensure that voids have been filled within abandoned sewer. Backgrouting will only be required at critical locations indicated on Drawings or if there is evidence of incomplete flowable fill placements.

1.04 REFERENCE STANDARDS

A. ASTM C 150 - Standard Specification for Portland Cement.

B. ASTM C 494 - Standard Specification for Chemical Admixture for Concrete.

C. ASTM C 618 - Standard Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.

D. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.

E. ASTM C 940 - Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Replaced Aggregate Concrete in the Laboratory.

F. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

G. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Flowable fill mix design report:

1. Flowable fill type and production method. Describe if fill will be mixed to final proportions and consistency in batch plant or if constituents will be added in transit mixer at placement location.

2. Use of ballast. Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.

3. Aggregate gradation of fill. Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.

4. Fill mix constituents and proportions including materials by weight and volume, and air content but excluding ballast. Give types and amounts of admixtures including air entrainment or air generating compounds.

5. Fill densities and viscosities, including wet density at point of placement.

6. Initial time of set.

7. Bleeding and shrinkage.

8. Compressive strength.

C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.

D. Experience record for proposed crew, showing minimum of 100 cubic yards of flowable fill placed using proposed or similar equipment and methods.

E. At least 60 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass

pumping requirements and plugging, if any, and other information pertinent to completion of work.

PART 2 PRODUCTS

2.01 FLOWABLE FILL

A. Design Mix Criteria per Section 02320 – Utility Backflow Materials.

B. Flowable Fill Requirements: Low Strength: Minimum 75 psi and maximum 150 psi at 28 days

2.02 BALLAST

A. Ballast Material: Natural rock or concrete pieces with minimum size equal to at least 10 times maximum aggregate size of flowable fill and maximum size of 24-In.. Maximum dimension shall not be more than 20 percent of minimum dimension of space to be filled.

B. Ballast Composition: Free of regulated waste material.

2.03 PLUGS FOR FORCE MAINS

A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C 1107, Grade B or C.

B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

PART 3 EXECUTION

3.01 PREPARATION

A. Have fill mix design reports and other submittals required by Paragraph 1.05 accepted by Public Works prior to start of placement. Notify Public Works at least 24 hours in advance of grouting with flowable fill.

B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portion of work, new or existing.

C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and

reconnected as part of this project, and report them to Public Works. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.

D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than 2 percent of placement volume. Dispose of waste material in compliance with Section 01576 - Waste Material Disposal.

E. Remove free water prior to starting fill placement.

3.02 EQUIPMENT

A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.

B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

3.03 DEMOLITION OF SEWER MANHOLES, PIPELINE STRUCTURES, AND FORCE MAINS PRIOR TO ABANDONMENT

A. Remove manhole frames and covers and castings from other existing pipeline structures. Deliver castings to nearest City maintenance facility for future use. Alternatively, salvaged castings may be used upon approval by Public Works, for constructing new manholes on this project.

B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar corbel and chimney, or other pipeline structure, to minimum depth of 4-Ft. below finished grade. Structure may be removed to greater depth, but not deeper than 18-In. above crown of abandoned sewer.

C. When adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.

D. Excavate overburden from force mains to be abandoned at locations indicated on Drawings, conforming to Section 02317 - Excavation and Backfill for Utilities. Cut existing force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove force main piping material remaining outside of

segment to be abandoned.

3.04 INSTALLATION

A. Sanitary sewer pipes smaller than 12" in diameter, are generally not required to be filled with flowable fill unless it is required by the plans. Pipes to be abandoned shall be filled, only if required on plans, by completely filling sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.

B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500-Ft. in length.

C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.

D. Temporarily plug sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.

E. Pump flowable fill through bulkheads constructed for placement of 2-In. PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.

F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sewer from downstream end, to discharge at upstream end.

G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.

H. Remediate placement of flowable fill which does not fill voids in sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sewer or from surface.

I. Plug each end of force main being abandoned.

J. Force main abandonment

1. Clean inside surface of force main at least 12-In. from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.
2. When using grout plug, place temporary plug or bulkhead approximately 12-In. inside pipe. Fill pipe end completely with dry-pack grout mixture.
3. When using manufactured plug or cap, install fitting as recommended by manufacture's instructions, to form water tight seal.

K. Backfill to surface, above pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with Section 02317 - Excavation and Backfill for Utilities.

L. Collect and dispose of excess flowable fill material and other debris in accordance with Section 01576 - Waste Material Disposal.

3.05 FIELD QUALITY CONTROL

A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.

B. Check flow characteristics and workability of fill as placement proceeds.

C. Obtain at least three test cylinders for each placement area for determination of 56-day compressive strength and bleeding. Acceptance of placement will be based on average strength of three tests.

D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.

3.06 PROTECTION OF PERSONS AND PROPERTY

A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.

B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to work.

END OF SECTION

SECTION 02233

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removing surface debris and rubbish.

B. Clearing site of plant life and grass.

C. Removing trees and shrubs.

D. Removing root system of trees and shrubs.

E. Fence removal.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for clearing and grubbing is on per acre basis.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate clearing work with utility companies.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are identified and tagged.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Living trees located 3-Ft. or more outside of intersection of side slopes and original ground line.

2. Plants other than trees and landscape features designated to remain.

3. Utilities designated to remain.

4. Bench marks, monuments, and existing structures designated to remain.

3.03 CLEARING

A. Remove stumps, main root ball, and root system to:

1. Depth of 24-In. below finished subgrade elevation in area bounded by lines 2-Ft. behind back of curbs.

2. Depth of 24-In. below finished surface of required cross section for other areas.

B. Clear undergrowth and deadwood without disturbing subsoil.

C. Remove vegetation from top soil scheduled for reuse and in areas designated to receive embankment.

3.04 REMOVAL

A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove on site fences. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION

SECTION 02260

TRENCH SAFETY SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Trench Safety System for the construction of trench excavations.

B. Trench Safety System for structural excavations that fall under provisions of State and Federal trench safety laws.

1.02 MEASUREMENT AND PAYMENT

A. No payment will be made under this section for trench safety systems. Include payment for trench safety systems in applicable structural or utility installation sections.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

B. The Trench Safety System requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and the installation to dimensions equivalent of a trench as defined.

C. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.

1.04 SUBMITTALS

A. Submit a safety program specifically for the construction of trench excavation. Design the Trench Safety Program to be in accordance with OSHA 29 CFR standards governing the presence and activities of individuals working in and around trench excavations.

B. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained by the Contractor.

C. Review of the safety program by the Owner will only be in regard to compliance with this specification and will not constitute approval by the Owner nor relieve the Contractor of obligations under State and Federal trench safety laws.

1.05 REGULATORY REQUIREMENTS

A. Install and maintain Trench Safety Systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P.

B. The Contractor is responsible for obtaining a reproduction of the OSHA standards included in “Subpart P-Excavations” from the Federal register Vol. 54, No. 209.

C. Legislation that has been enacted by the Texas Legislature with regard to trench safety systems is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code § 756.023.

1.06 INDEMNIFICATION

A. Contractor shall indemnify and hold harmless the Owner, its employees and agents, form any and all damages, cost (including, without limitation, legal fees, court cost, and the cost of investigation), judgments or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and maintain Trench Safety Systems in accordance with provisions of OSHA 29 CFR.

B. Install specially designed Trench Safety Systems in accordance with the Contractor’s trench excavation safety program for the locations and conditions identified in the program.

C. A competent person, as identified in the Contractor’s trench safety program, shall verify that trench boxes and other pre-manufactured systems are

certified for the actual installation conditions.

3.02 INSPECTION

A. Contractor shall make daily inspection of Trench Safety Systems to ensure that the installed systems and operations meet OSHA 29 CFR and other personnel protection regulations requirements.

B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until necessary precautions have been taken by the Contractor to safeguard personnel entering the trench.

C. Maintain a permanent record of daily inspections.

3.03 FIELD QUALITY CONTROL

A. Contractor shall verify specific applicability of the selected or specially designed Trench Safety Systems to each field condition encountered on the project.

END OF SECTION

SECTION 02314

CHANNEL EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A Excavate open channels within the limits shown on the plans, regardless of the type of material encountered, and dispose of any unused excavated materials. Construct, shape and finish all earthwork involved in conformance with the required lines, grades and cross sections, and in accordance with the plans and specification requirements.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Accepted channel excavation for open channels will be measured in its original position and the volume computed in cubic yards by the method of average end areas in accordance with the lines, grades and cross sections shown on the plans.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 1REFERENCES

A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.44 ft-lb f/ft^3).

B. ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

C. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 3017 - Standard Test Method for Water content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 MATERIALS:

A. All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed, except those covered by other pay items.

B. Hazardous Materials. If the Contractor encounters hazardous substances, industrial waste, other environmental pollutants, underground storage tanks, or conditions conducive to environmental damage, Contractor shall immediately stop work in the area affected and report the condition to the Owner's representative in writing. Contractor shall not be responsible for or required to conduct any investigation, site monitoring, containment, cleanup, removal, restoration or other remedial work of any kind or nature (the "remedial work") under any applicable level, state or federal law, regulation or ordinance, or any judicial order. If the Contractor agrees in writing to commence and/or prosecute some or all of the remedial work, all costs and expenses, to include any extension of the contract time, of such remedial work shall be paid by Owner to Contractor as additional compensation.

C. Existing Structures/Obstructions. Removal of structures and other obstructions prior to excavation and finishing of all other earthwork described herein shall be completed and paid for in accordance with Item 101, "Preparing Right-of-Way" unless otherwise stated on the plans.

D. Existing Asphaltic Materials. All asphaltic material shall be disposed of or recycled at a facility authorized to accept the material for such purposes.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Provide applicable equipment to conduct work as described in this specification or as specified on the plans.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. All channel excavation shall be performed as shown on the plans, or specified herein if not denote on the plans, and shall conform to the established alignment, grades and cross sections. Suitable excavated materials shall be utilized, insofar as practicable, in constructing required embankments, or backfilling around drainage structures. Unsuitable excavation or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor and it shall become his sole responsibility to dispose of this material off the limits of the right-of-way. Proper disposal shall be in conformance with, but not limited to, the following provisions:

1. Do not deposit excavated material within jurisdictional wetlands, and

2. Obtain appropriate permits and apply provisions pertaining to soil erosion and stream pollution, when necessary, to meet federal and/or local regulations, rules, and procedures.

B. Temporary Construction Access. Any temporary construction access that crosses a channel will be constructed so as to allow a continuous flow at all times. The channel flow line will not be blocked or raised at any temporary construction access.

C. Channel Side Slope (Fill). When the plans indicate fill of a channel side slope, the fill material shall be placed in layers not to exceed 12 inches and shall be benched or notched into existing slopes. Each lift of fill shall be compacted to the required density and moisture content as shown below, unless otherwise shown on the plans:

SUBGRADE MATERIAL	DENSITY	MOISTURE CONTENT
PI ≤ 20	≥ 95% of Max Dry Density	- 2% of Opt. or greater
PI > 20	≥ 95% of Max Dry Density	≥ Opt. Moisture

The maximum dry density and optimum moisture content shall be determined in accordance with TxDOT Test Method Tex-114-E. Tests for in place density shall be made in accordance with TxDOT Test Method Tex-115-E and within 24 hours after compacting operations are completed. If the material fails to meet the density specified, it shall be re-worked as necessary to obtain the density required.

The fill material shall be free from roots, trash, silt and objectionable debris and shall be approved by the Engineer. The channel side slopes, in fill areas, shall be cut to the finished dimensions after completion of the fill process.

D. Lateral Ditches. At locations where lateral ditches enter the channel, the Contractor shall perform grading as may be required to maintain lateral ditch side slopes within the easement area. The cost of all grading shall be considered incidental to the unit price bid and no extra payment will be made.

E. Channel Completion. Prior to final acceptance by the Engineer, the Contractor shall remove all sediment from the bottom of the channel and dispose of this material off site. The cost of sediment removal and grading shall be incidental to the unit price bid, and no extra payment will be made. Revegetation is not required on channels primarily composed of rock.

END OF SECTION

SECTION 02315

ROADWAY EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation and compaction of materials for roadways.

B. Excavation and compaction of materials for roadside ditches.

1.02 MEASUREMENT AND PAYMENT

A Unit Prices.

1. Payment for roadway excavation is on cubic yard basis.

2. No payment will be made for material excavated under the following conditions:
   a. More than 2-Ft. outside of vertical planes behind back of curbs
   b. For portion within limits of trench for utilities 24-In. and greater constructed by open-cut methods
   c. As indicated otherwise on Drawings.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.44 ft-lbf/ft^3).

B. ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

C. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 3017 - Standard Test Method for Water content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and

Plasticity Index of Soils.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide topsoil conforming to requirements of Section 02911 - Topsoil.

B. Provide backfill which is excavated material, graded free of roots, lumps greater than 6-In., rocks larger than 3-In., organic material, and debris.

C. Provide structural backfill which is select material meeting following requirements:

1. Plasticity index: Not less than 12 not more than 20.

2. Maximum liquid limit: 45

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, and datum.

B. Identify and flag surface and aerial utilities.

C. Notify utility companies to remove or relocate utilities.

D. Identify, stake, and flag known utility locations below grade. Make temporary or permanent relocation of underground pipes, ducts, or utilities where indicated on Drawings.

E. Upon discovery of unknown or badly deteriorated utilities, or concealed conditions, discontinue work. Notify Public Works and obtain instructions before proceeding in such areas.

F. Obtain approval of top soil quality before excavating and stockpiling.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Trees, shrubs, lawns, existing structures, and other features outside of grading limits.

2. Utilities either above or below grade, which are to remain.

3.03 TOPSOIL REMOVAL

A. Strip off topsoil from area to be excavated to minimum depth of 6-In., unless indicated otherwise on Drawings.

B. Stockpile topsoil in designated location for reuse. Stockpile topsoil to depth not exceeding 8-Ft. Cover to protect from erosion.

3.04 SOIL EXCAVATION

A. Excavate to lines and grades shown on Drawings.

B. Remove unsuitable material not meeting specifications. Backfill with embankment materials and compact to requirements of Section 02330 - Embankment.

C. Record location and plug and fill inactive water wells. Conform to Texas Department of Health, Texas Commission on Environmental Quality, and Texas Railroad Commission requirements. Notify Public Works prior to plugging wells.

D. At intersections, grade back at minimum slope of 1-In./Ft. Produce smooth riding junction with intersecting street. Maintain proper drainage.

E. When area is inadvertently over excavated, fill area in accordance with requirements of Section 02330 - Embankment at no additional cost to the City.

F. Remove material not qualified for use and excess soil not being reused from site in accordance with requirements of Section 01576 - Waste Material Disposal.

3.05 COMPACTION

A. Maintain optimum moisture content of subgrade to attain required density.

B. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings:

1. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.

2. Other areas: Minimum density of 90 percent of maximum dry density.

3.06 TOLERANCES

A. Top of Compacted Surface: Plus or minus ½-In. in cross section, or in 16-Ft. length.

3.07 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 – Quality Control.

B. Test and analysis of soil materials will be performed in accordance with ASTM D 4318, ASTM D 2216, and ASTM D 698.

C. Compaction testing will be performed in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017.

D. A minimum of three tests will be taken for each 1000 linear feet per lane of roadway.

E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at no additional cost to the City.

3.08 PROTECTION

A. Prevent erosion at all times. Maintain ditches and cut temporary swales to allow natural drainage in order to avoid damage to roadway. Do not allow water to pond.

B. Distribute construction traffic evenly over compacted areas, where practical, to aid in obtaining uniform compaction. Protect exposed areas having high moisture content from wheel loads that cause rutting.

C. Maintain excavation and embankment areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density.

END OF SECTION

SECTION 02316

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation, backfilling, and compaction of backfill for structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for structural excavation and backfill under this Section. Include payment in unit price or lump sum for construction of structures.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4-In. in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.

C. Select Material: Material as defined in Section 02320 - Utility Backfill Materials.

D. Backfill: Select material meeting specified quality requirements, placed and compacted under controlled conditions around structures.

E. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

F. Foundation Base: For foundation base material, use crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation base provides smooth, level working surface for construction of concrete foundation.

G. Foundation Subgrade: Foundation subgrade is surface of natural soil which has been excavated and prepared to support foundation base or foundation backfill, where needed.

H. Ground Water Control Systems: Installations external to excavation such as well points, educators, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from excavation. Remove rain water and surface water which accidentally enters excavation as part of excavation drainage.

J. Excavation Drainage: Removal of surface and seepage water in excavation by sump pumping and using French drains surrounding foundation to intercept water.

K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below foundation as shown on Drawings, and backfilled with foundation backfill material.

L. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins.

1.04 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soil Using Standard Effort (12,400 Ft.-Lb./Ft^3 (600kN-m/m^3)).

B. ASTM D 1556 - Standard Test Method for Density of Soil in Place by Sand-Cone Method.

C. ASTM D 2922 - Standard Test Methods for Density of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 3017 - Standard Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).

E. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

F. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

G. TxDOT Tex-110-E - Particle Size Analysis of Soils.

H. Federal Regulations, 29 CFR, Part 1926, Standards - Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit work plan for excavation and backfill for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to excavation and backfill activities. Use descriptions, with supporting illustrations, sufficiently detailed to demonstrate to Public Works that procedures meet requirements of Specifications and Drawings.

C. Submit excavation safety system plan.

1. Submit excavation safety system plan in accordance with applicable OSHA requirements for excavations.

2. Submit excavation safety system plan in accordance with requirements of Section 02260 - Trench Safety System, for excavations that fall under State and Federal trench safety laws.

D. Submit ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water

and Surface Water.

E. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

F. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.06 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform embedment and backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Perform excavation with equipment suitable for achieving requirements of this Specification.

B. Use equipment which will produce degree of compaction specified. Compact backfill within 3-Ft. of walls with hand operated equipment. Do not use equipment weighing more than 10,000-Lb. closer to walls than a horizontal distance equal to depth of fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.02 MATERIAL CLASSIFICATIONS

A. Use backfill materials conforming to classifications and product descriptions of Section 02320 - Utility Backfill Materials. Use classification or product description for backfill applications as shown on Drawings and as specified.

PART 3 EXECUTION

3.01 PREPARATION

A. Conduct an inspection to determine condition of existing structures

and other permanent installations.

B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where affected by work, and is considered hazardous to traffic movements.

C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 02260 - Trench Safety Systems.

D. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

E. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

3.02 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.

E. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to the City.

3.03 EXCAVATION

A. Perform excavation work so that underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing

facilities and improvements. Keep excavation to absolute minimum necessary. No additional payment will be made for excess excavation not authorized by Public Works.

B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Public Works and obtain instructions before proceeding in such areas.

C. Immediately notify agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Public Works and agency for any repairs or relocations, either temporary or permanent.

D. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.

E. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.

F. Conduct hauling operations so that trucks and other vehicles do not create dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner such that objectionable materials will not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.

G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by work.

H. Provide sheeting, shoring, and bracing where required to safely complete work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect work and adjacent structures or improvements. Use sheeting, shoring, and bracing to protect workmen and public conforming to requirements of Section 02260 - Trench Safety Systems.

I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, cement stabilized sand, or other material approved by Public Works and compact to 95 percent standard density.

J. After completion of structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Public Works in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to work and

adjacent structures or improvements.

K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or other material approved by Public Works and compact to 95 percent standard density.

3.04 HANDLING EXCAVATED MATERIALS

A. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at sufficient distance from excavation to prevent slides or cave-ins.

B. Provide additional backfill material in accordance with requirements of Section 02319 - Borrow, if adequate quantities of suitable material are not available from excavation and trenching operations at site.

3.05 DEWATERING

A. Provide ground water control per Section 01578 - Control of Ground Water and Surface Water.

B. Keep ground water surface elevation minimum of 2-Ft. below bottom of foundation base.

C. Maintain ground water control as directed by Section 01578 - Control of Ground Water and Surface Water and until structure is sufficiently complete to provide required weight to resist hydrostatic uplift with minimum safety factor of 1.2.

3.06 FOUNDATION EXCAVATION

A. Notify Public Works at least 48 hours prior to planned completion of foundation excavations. Do not place foundation base until excavation is accepted by Public Works.

B. Excavate to elevations shown on Drawings, as needed to provide space for foundation base, forming level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or material as directed by Public Works. Prior to placing material over it, recompact subgrade where indicated on Drawings, scarifying as needed, to 95 percent of maximum Standard Dry Density according to ASTM D 698. If specified level of compaction cannot be achieved, moisture condition subgrade and recompact until 95 percent is achieved, over-excavate to provide minimum layer of 24-In. of foundation backfill material, or other means acceptable to Public Works.

C. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by Public Works.

D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.

E. Remove soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to required subgrade, and replace with foundation backfill material, as directed by Public Works, at no additional cost to the City.

F. Place foundation base, or foundation backfill material where needed, over subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with seal slab or cement-stabilized sand.

G. Use filter fabric as specified in Section 02621 - Geotextile to separate crushed aggregate, and other free draining Class I materials from native soils or select material backfill. Overlap fabric minimum of 12-In. beyond where another material stops contact with soil.

H. Place crushed aggregate, and other Class I materials, in uniform layers of 8-In. maximum thickness. Perform compaction by means of at least two passes of vibratory compactor.

3.07 FOUNDATION BASE.

A. Place foundation base after subgrade is properly prepared, including placement of foundation backfill where needed. Use foundation base consisting of 12-In. layer of crushed stone aggregate or cement stabilized sand. Alternately, seal slab with minimum thickness of 4-In. may be placed. Extend foundation base minimum of 12-In. beyond edge of structure foundation, unless shown otherwise on Drawings.

B. Where foundation base and foundation backfill are of same material, both can be placed in one operation.

3.08 BACKFILL

A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Remove forms, lumber, trash and debris from structures. Use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified.

B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that concrete has reached minimum of 85 percent of specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until slab or intermediate walls have been placed and concrete has attained sufficient strength.

C. Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.

D. Maintain backfill material at no less than 2 percent below nor more than 2 percent above optimum moisture content, unless otherwise approved by Public Works. Place fill material in uniform 8-In. maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698 below paved areas. Compact fill to at least 95 percent around structures below unpaved areas.

E. Where backfill is placed against sloped excavation surface, run compaction equipment across boundary of cut slope and backfill to form compacted slope surface for placement of next layer of backfill.

F. Place backfill using cement stabilized sand in accordance with Section 02321 – Cement Stabilized Sand.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Tests will be performed initially on minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity.

C. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 698, Tex 114-E, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions:

1. Minimum of one test for every 50 to 100 cubic yards of compacted backfill material or as directed by Public Works.

2. A minimum of three density tests for each full work shift.

3. Density tests will be performed in all placement areas.

4. Number of tests will be increased when inspection determines that soil types or moisture contents are not uniform or when compacting effort is variable and not considered sufficient to attain uniform density.

5. Identify elevation of test with respect to natural ground.

6. Record approximate depth of lift tested.

D. At least one test for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Perform additional moisture-density relationship test once a month or whenever there is noticeable change in material gradation or plasticity.

E. When tests indicate work does not meet specified compaction requirements, recondition, re-compact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

Dispose of excess materials in accordance with requirements of Section 01576 – Waste Material Disposal.

END OF SECTION

SECTION 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation, trenching, foundation, and backfill for installation of utilities, including manholes and other pipeline structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

2. When Public Works directs Contractor to overexcavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6" Overexcavation of Trench Bottom.

   a. No payment will be paid if Public Works does not direct Contractor to overexcavate trench bottom.

   b. No overexcavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 - Control of Ground Water and Surface Water.

3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost for unit price for work requiring critical location.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of initial backfill as shown on Drawings, or foundation backfill material placed and compacted in over-

excavated areas to replace unsuitable or unstable materials.

B. Initial Backfill: Portion of trench backfill that extends vertically from top of foundation up to level line 12-inch above top of pipe, and horizontally from one trench sidewall to opposite sidewall. Includes the commonly used terms and areas pipe foundation, pipe embedment, and haunching.

C. Secondary Backfill: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

D. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4-inch in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

E. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

F. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

G. Ground Water Control Systems: Installations external to trench, such as well points, educators, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

H. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

I. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

J. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.

a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.

b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

K. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.

L. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.

M. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with

foundation backfill material.

N. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

O. Trench Safety Systems include both protective systems and shoring systems as defined in Section 02260 - Trench Safety Systems.

P. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave- in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.

Q. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.

R. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

1.04 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.

B. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Particle Size Analysis of Soils.

L. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SCHEDULING

A. Schedule work so that initial backfill can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit planned typical method of excavation, backfill placement and compaction including:

1. Trench widths.

2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.

3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.

C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

D. Submit trench excavation safety program in accordance with requirements of Section 02260 - Trench Safety System. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.

E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

F. Submit 11-inch by 17-inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Public Works.

1.07 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

1.08 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12-inch is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

A. Initial Backfill and Secondary Backfill Materials: Conform to classifications

and product descriptions of Section 02320 - Utility Backfill Materials.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 EXECUTION

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

C. Classification of material will be determined by Public Works.

3.02 PREPARATION

A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Section 02260 - Trench Safety Systems.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Public Works and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground Water and Surface Water. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed.

3.03 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2-foot vertically and 4-foot horizontally of proposed work.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.

2. Notify Public Works in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Public Works is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Public Works with 48 hours notice prior to field excavation or related work.

C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 11-inch by 17-inch copy of Drawings. For large diameter water lines, submit to Public Works for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

3.04 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent

objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to the City.

3.05 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.).

Nominal Pipe Size, Inches	**Minimum Trench Width, Inches**
Less than 18	O.D. + 12
18 to 30	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

D. Use sufficient trench width or benches above Initial Backfill zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Public Works and obtain instructions before proceeding.

F. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or

simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.

2. For all types of shoring, support trench walls in Initial Backfill zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.

3. Leave sheeting driven into or below Initial Backfill zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Public Works. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.

4. Employ special methods for maintaining integrity of Initial Backfill or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of Initial backfill zone, do not disturb pipe foundation and Initial Backfill materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch thick steel plate. As sheeting is removed, fill in voids left with grouting material.

G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.

3. When required, place, spread, and compact Initial Backfill materials beneath shield. For backfill above Initial Backfill, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.

5. Conform to applicable Government regulations.

H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by Pipeline Company's representative. Use small, rubber- tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1-foot of Pipeline Company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company's representative.

K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy- acetylene weld is exposed, immediately notify Public Works. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

3.06 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct

sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.07 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or Initial Backfill.

B. When wet soil is encountered on trench bottom and dewatering system is not required, over-excavate an additional 6-inch with approval by Engineering. Place non-woven geotextile fabric and then compact 6-inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, if directed by Engineering, in accordance with Paragraph 3.07B above. Removal of unstable or unsuitable material may be required if directed by Engineering;

1. Even though Contractor has not determined material to be unsuitable, or

2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 - Control of Ground Water and Surface Water.

D. Place trench dams in Class I foundations in line segments longer than 100-foot between manholes and not less than one in every 500-foot of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5-foot from manholes.

3.08 INITIAL BACKFILL, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread Initial Backfill material around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of the material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of Initial Backfill zone

unless means to maintain density of compacted material are used. If moveable supports are used in Initial Backfill zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact Initial Backfill material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. Use materials as specified in Section 02320 - Utility Backfill Material.

K. Place trench dams in Class I embedment in line segments longer than 100-foot between manholes, and not less than one in every 500-foot of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5-foot from manholes.

3.09 SECONDARY BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.

B. Provide material as specified in Section 02320 – Utility Backfill Materials and as per City of Schertz Standard Drawings.

1. Place backfill in 8-inch maximum loose lifts and compact. Fully compact and density test each lift before placement of next lift.

2. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

3. Moisture content within zero percent to +5 percent of optimum

determined according to ASTM D 698, unless otherwise approved by Public Works.

F. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5-foot or more above crown of pipe. Remove trench supports within 5-foot from ground surface.

G. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Meet requirements of adjoining utility installations for backfill of pipeline structures, as shown on Drawings.

B. Below paved areas, encapsulate manhole with flowable fill; beginning at bottom of base and a minimum 1-foot around walls, up to the bottom of the pavement surface.

C. In unpaved areas, use Select Backfill, or flexible base material, for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Public Works. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to City.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Public Works.

D. At least three tests for moisture-density relationships will be performed

initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted materials will be performed according to ASTM D 698, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.

1. For open cut construction projects and auger pits: Unless otherwise approved by Public Works, successful compaction to be measured by one test per 100-foot measured along pipe.

2. A minimum of three density tests for each full shift of work.

3. Density tests will be distributed among each lift of backfill placed.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at same frequency as first test series, including verification tests.

8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, recompact, and retest at Contractor's expense if tests indicate work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 – Waste Material Disposal.

END OF SECTION

SECTION 02319

BORROW

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Soil materials for embankment.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for borrow is on cubic yard basis calculated by theoretical quantities using average end area method based on Drawings.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.

B. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit location and description of proposed borrow area for approval.

C. Submit material samples for testing.

PART 2 PRODUCTS

2.01 SOIL MATERIAL

A. Grade borrow material used for embankment free of lumps greater than 6 inches, rocks larger than 3-In., organic material, chemical waste or other

SECTION 02320

UTILITY BACKFILL MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials: Grade 5 Gravel, Washed Rock, Crushed Aggregates, Concrete Backfill, Flexible Base Course Material, Secondary Backfill, and Flowable Fill.

C. Material Handling and Quality Control Requirements.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for backfill material. Include payment in unit price for applicable utility installation.

2. Payment for backfill material, when included as separate pay item or when directed by Public Works, is on cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings, or as directed by Public Works.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material:

1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials containing large clods, aggregates, or stones greater than 4-in. in any dimension; debris, vegetation, or waste; or any other deleterious materials.

4. Materials contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material:

1. Materials meeting specification requirements.

2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.

C. Backfill Material: Classified soil material meeting specified quality requirements for designated application as initial or secondary backfill.

D. Initial Backfill: Soil material placed under controlled conditions extending vertically upward from top of foundation to an elevation 12-In. above top of pipe.

E. Secondary Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of initial backfill zone to base course in paved areas or to surface grading material in unpaved areas.

F. Foundation: Either suitable soil of trench bottom or material placed as backfill after the removal and replacement of unsuitable or otherwise unstable soils.

G. Source: Source selected by Contractor for supply trench zone backfill material. Selected source may be project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

H. Refer to Section 02317 - Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

1.04 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregate.

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.

E. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM D 1140 - Standard Test Method for Amount of Material in Soils Finer Than No. 200 Sieve.

H. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. ASTM D 4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Method.

K. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.

L. TxDOT Tex-460-A - Material Finer Than 75 Fm (No.200) Sieve In Mineral Aggregates (Decantation Test for Concrete Aggregates).

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials. Comply with Paragraph 2.03, Material Testing.

D. Before stockpiling materials, submit copy of approval from landowner for stockpiling backfill material on private property.

E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off-site sources or is being paid as specific bid item.

1.06 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.03B.

B. Verification tests of backfill materials may be performed by the City in accordance with Section 01454 - Testing Laboratory Services and in accordance with Paragraph 3.03.

PART 2 PRODUCTS

2.01 MATERIAL CLASSIFICATIONS

A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use

and application is defined in utility installation specifications and Drawings.

2.02 PRODUCT DESCRIPTIONS

A. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by Public Works.

B. Provide backfill material that is free of stones greater than 4-In., free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to following limits for deleterious materials:

1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.

2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.

3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Public Works, provided that physical property criteria are determined to be satisfactory by testing.

D. Grade 5 Gravel: Durable crushed aggregates graded within the following limits when tested in accordance with ASTM C 136 shall be used for initial backfill for water lines:

Sieve	Percent Retained
1/2"	0
3/8”	0 to 5
No.4	20 to 80
No. 10	75 to 100
No. 20	98 to 100

E. Washed Rock: Durable crushed aggregates graded within the following limits when tested in accordance with ASTM C 136 shall be used for initial backfill for all pipes other than water lines:

Sieve	Percent Passing
1”	100
3/4”	90 to 100
3/8”	20 to 55
No. 4	0 to 10
No. 8	0 to 5

F. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for same construction activity from single source, unless otherwise approved by Public Works.

2. Non-plastic fines.

3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.

4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.

5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable materials for initial backfill where crushed stone is shown on applicable utility drawing details.

6. Crushed concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. 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.

G. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

H. Flexible Base Course Material: Conform to requirements of applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Crushed Concrete

Base Course.

I. Flowable Fill:

1. Design Mix Criteria. Provide design of one or more mixes to meet design criteria and conditions for placement. Present information required by Paragraph 1.05B in mix design report including following:

a. Cement: ASTM C 150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 50-Lb. per cubic yard.

b. Fly ash: ASTM C 618 Class C or F. Volume and weight per cubic yard of fill. No more than 250 lbs. of fly ash per cubic yard may be used.

c. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.

d. Aggregate gradation: 100 percent passing 3/8-In. sieve and not more than 10 percent passing No. 200 sieve. Mix design report shall define pilot gradation based on following sieve sizes 3/8-In., Nos. 4, 8, 16, 30, 50, 100, and 200. Do not deviate from pilot gradation by more than plus or minus 10 percentage points for any sieve for production material.

e. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, add at least 30 percent of natural aggregate to provide workability.

f. Admixtures: Use admixtures meeting ASTM C 494 and ASTM C 1017 as needed to improve pumpability, to control time of set, and reduce bleeding.

g. Fluidifier: Use fluidifier meeting ASTM C 937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.

h. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, to control fill properties.

2. Flowable Fill Requirements

a. Unconfined compressive strength as determined based on an average of three tests for same placement. Present at least

three acceptable strength tests for proposed mix design in mix design report:

i. Low Strength: Minimum 30 psi and maximum 100 psi @ 28 days
ii. For emergency repairs, strength shall be greater than 30 psi @ 2 hours.

b. Placement characteristics: self-leveling.

c. Shrinkage characteristics: Limit shrinkage to 0.5% or less based upon the results from ASTM C 827, “Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures”.

d. Water bleeding for fill to be placed by grouting method in sewers: Not to exceed 2 percent according to ASTM C 940.

2.03 MATERIAL TESTING

A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source characteristics change or there is planned change in source location or supplier. Include the following qualification tests, as applicable:

1. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.
2. Plasticity of material passing No. 40 sieve
3. Los Angeles abrasion wear of material retained on No. 4 sieve
4. Clay lumps
5. Lightweight pieces
6. Organic impurities

B. Production Testing. Provide reports to Public Works from an independent testing laboratory that backfill materials to be placed in work meet applicable specification requirements.

C. Assist Public Works in obtaining material samples for verification testing at source or at production plant.

PART 3 EXECUTION

3.01 SOURCES

A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that Public Works may obtain samples for verification testing.

C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by Public Works, expense for sampling and testing required to change to different material will be credited to the City through change order.

D. The City does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as backfill material.

3.02 MATERIAL HANDLING

A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.

B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Public Works in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.03 FIELD QUALITY CONTROL

A. Quality Control

1. The Public Works may sample and test backfill at:

    a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
    b. On-site stockpiles.
    c. Materials placed in work.

2. The Public Works may re-sample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: City's testing laboratory will provide verification testing on backfill materials, as directed by Public Works. Samples may be taken at source or at production plant, as applicable.

END OF SECTION

SECTION 02321

CEMENT STABILIZED SAND

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cement stabilized sand.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of such work in Contract unit prices for items listed in bid form requiring cement stabilized sand.

2. Refer to Paragraph 3.04 for material credit.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates (Fine Aggregate).

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

E. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM C 150 - Specification for Portland Cement.

H. ASTM D 558 - Standard Test Method for Moisture-Density Relations of Soil Cement- Mixtures.

I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory

J. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

K. ASTM D 2487 - Standard Test Method for Classification of Soils for Engineering Purposes Unified Soil Classification System).

L. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

M. ASTM D 3665 - Standard Practice for Random Sampling of Construction Materials.

N. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.03, Materials Qualifications.

1.05 DESIGN REQUIREMENTS

A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.

1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.

2. Determine minimum cement content from production data and statistical history. Provide no less than 1.1 sacks of cement per ton of dry sand.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Section 02320 - Utility Backfill Materials, and the following requirements:

1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.

2. Deleterious materials:

a. Clay lumps, ASTM C 142 - less than 0.5 percent.

b. Lightweight pieces, ASTM C 123; less than 5.0 percent.

c. Organic impurities, ASTM C 40, color no darker than standard color.

3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.02 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.03 MATERIAL QUALIFICATION

A. Determine target cement content of material as follows:

1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.

2. Complete molding of samples within 4 hours after addition of water.

3. Perform strength tests (average of two specimens) at 48 hours and 7 days.

4. Perform cement content tests on each sample.

5. Perform moisture content tests on each sample.

6. Plot average 48-hour strength vs. cement content.

7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).

B. Test raw sand for following properties at point of entry into pug-mill:

Gradation
Plasticity index
Organic impurities
Clay lumps and friable particles
Lightweight pieces
Moisture content
Classification

C. Present data obtained in format similar to that provided in sample data form attached to this Section.

D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:

f'_c% 1/2 standard deviation

PART 3 EXECUTION

3.01 PLACING

A. Place sand-cement mixture in maximum 12-In. thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is +3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

B. Do not place or compact sand-cement mixture in standing or free water.

3.02 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15-Lb. each from the first, middle, and last third of the truck and composite them into one sample for test purpose.

C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.

D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

H. Reporting: Test reports shall contain, as a minimum, the following information:

Supplier and plant number
Time material was batched
Time material was sampled
Test age (exact hours)
Average 48-hour strength
Average 7-day strength
Specification section number
Indication of compliance / non-compliance
Mixture identification
Truck and ticket numbers
The time of molding
Moisture content at time of molding
Required strength
Test method designations

Compressive strength data as required by ASTM D 1633
Supplier mixture identification
Specimen diameter and height, in.
Specimen cross-sectional area, sq. in.

3.03 ACCEPTANCE

A. Strength level of material will be considered satisfactory if:

1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.

2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.

B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C. The material will be considered unacceptable and subject to removal and replacement at Contractor's expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi.

D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. Testing laboratory shall notify Contractor, Public Works, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.

G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.04 ADJUSTMENT FOR DEFICIENT STRENGTH

A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:

$$\text{Credit per Cubic Yard} = \frac{\$30.00 \times 2\,(100 \text{ psi} - \text{Actual psi})}{100}$$

C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to the City.

END OF SECTION

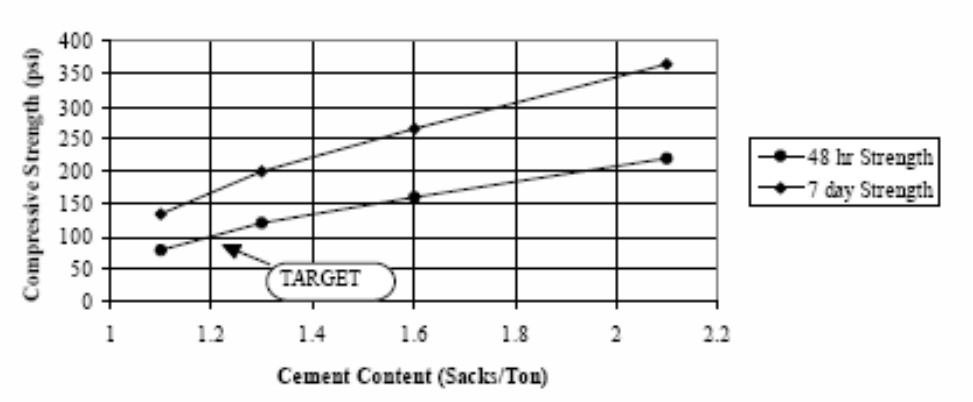
Supplier: City Stabilized Sand	**Plant No:** 1 - Main Street	**Date of Tests:** January 1, 1997

Item	Raw Sand	1.1 Sack	100 psi	1.5 Sack	2.0 Sack
Moisture Content	10.9	15.7	14.0	13.8	13.7
Cement Feed Dial Setting	--	2.25	2.5	2.75	3.75
Silo Pressure (psi)	--	4	4	4	4
Batch Time	10:00	10:10	10:15	10:20	10:25
Sample Time	--	10:10	10:15	10:20	10:25
Molding Time	--	12:30	12:45	1:00	1:15
Cement Content (sacks/ton)	--	1.1	1.3	1.6	2.1
Compressive Strength at 48 hrs. (avg of 2)	--	80	120	160	220
Compressive Strength at 7 days(avg of 2)	--	135	200	265	365

Sieve size	Percent Passing	Spec. Section 02320
3/8 Inch	100	--
No. 16	100	--
No. 40	100	--
No. 50	99	--
No. 100	41	--
No. 200	11	0 to 15

Raw Sand Tests	Result	City of Schertz
Plasticity Index	Non-Plastic	4 Maximum
Organic Impurities	Passing	No Darker Than
Clay Lumps & Friable Parts (%)	0.0	0.5 % Maximum
Lightweight Pieces (%)	0.0	5.0 % Maximum
Classification	SP-SM	SW, SP, SW-SM, SP-SM, SM

Compressive Strength vs Cement Content



SECTION 02330

EMBANKMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of embankments with excess excavated material and borrow.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for embankment under this section. Include payment in unit price for excavation or borrow.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).

B. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

PART 2 PRODUCTS

2.01 MATERIALS

A. Refer to Section 02315 - Roadway Excavation for acceptable excess materials from roadway excavation.

B. Refer to Section 02317 - Excavation and Backfill for Utilities for acceptable excess materials from utility excavation and trenching.

C. Refer to Section 02319 - Borrow for acceptable borrow materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify borrow and excess excavated materials to be reused are approved.

B. Verify removals and clearing and grubbing operations have been completed.

3.02 PREPARATION

A. Backfill test pits, stump holes, small swales and other surface irregularities. Backfill and compact in designated lift depths to requirements for embankment compaction.

B. Record location and plug and fill inactive water wells. Conform to the Texas State Health Department, Texas Commission on Environmental Quality and Texas Railroad Commission requirements. Notify the City Engineer prior to plugging wells.

C. Excavate and dispose of unsuitable soil and other unsuitable materials which will not consolidate. Backfill and compact to requirements for embankment. Unsuitable soil is defined in Section 02316 - Excavation and Backfill for Structures and Section 02320 - Utility Backfill Materials, and Section 02315 Roadway Excavation.

D. Backfill new utilities below future grade. Conform to requirements of Sections 02317 - Excavation and Backfill for Utilities, 02511 - Water Lines, 02531 - Gravity Sanitary Sewers, and 02532 - Sanitary Sewage Force Mains.

3.03 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other features outside of embankment limits.

B. Protect utilities above and below grade, which are to remain.

C. Conform to protection requirements of Section 02315 - Roadway Excavation.

3.04 PLACING EMBANKMENT

A. Do not conduct placement operations during inclement weather or when existing ground or fill materials exceed 3 percent of optimum moisture content. Contractor may manipulate wet material to facilitate drying, by disking or windrowing.

B. Do not place embankment fill until density and moisture content of previously placed material comply with specified requirements.

C. Scarify areas to be filled to minimum depth of 4-inch to bond existing and new materials. Mix with first fill layer.

D. Spread fill material evenly, from dumped piles or windrows, into horizontal layers approximately parallel to finished grade. Place to meet specified compacted thickness. Break clods and lumps and mix materials by blading, harrowing, disking or other approved method. Extend each layer across full width of fill.

E. Each layer shall be homogeneous and contain uniform moisture content before compaction. Mix dissimilar abutting materials to prevent abrupt changes in composition of fill.

F. Layers shall not exceed the following compacted thickness:

1. Areas indicated to be under future paving or shoulders, to be constructed within 6 months: 6-inch when compacted with pneumatic rollers, or 8-inch when compacted with other rollers.

2. Other areas: 12-inch

G. For steep slopes, cut benches into slope and scarify before placing fill. Place increasingly wider horizontal layers of specified depth to level of each bench.

H. Build embankment layers on back slopes, adjacent to existing roadbeds, to level of old roadbed. Scarify top of old roadbed to minimum depth of 4-inch and re-compact with next fill layer.

I. Construct to lines and grades shown on Drawings.

J. Remove unsuitable material and excess soil not being used for embankment from site in accordance with requirements of Section 01576 - Waste Material Disposal.

K. Maintain moisture content of embankment materials to attain required density.

L. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings:

1. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.

2. Other areas: Minimum density of 90 percent of maximum dry density.

3.05 TOLERANCES

A. Top of compacted surface: Plus or minus ½-inch in cross section or 16-Ft. length.

3.06 FIELD QUALITY CONTROL

A. Compaction Testing will be performed in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017 under provisions of Section 01454 - Testing Laboratory Services.

B. A minimum of three tests will be taken for each 1000-Ft. per lane of roadway or 500 square yards of embankment per lift.

C. If tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at no cost to the City.

END OF SECTION

SECTION 02427

PLASTIC LINER FOR LARGE-DIAMETER CONCRETE SEWERS AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of plastic liners for concrete interceptor sewers and structures. Only plastic liners manufactured with integral locking ribs spaced at approximately 2-1/2 inches on center over entire liner is acceptable. Liners relying on mechanically fastened batten strips as primary means of anchorage are unacceptable.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for Work performed under this Section. Cost is incidental to work of large diameter sewers, precast concrete manholes, or cast- in-place, wastewater-containing structures.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCE STANDARDS

A. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers-Tension.

B. ASTM D 2440 - Standard Test Methods for Oxidation Stability of Mineral Insulating Oil.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Prior to submittal of shop drawings, manufacturer shall approve proposed panel layout and proposed details. Contractor shall then submit shop drawings showing proposed panel layout to cover area to be lined. Show on shop drawings proposed details for installation of liner at seams,

terminations, corners, openings, pipe penetrations, etc., and type of factory and field welds and attachments.

C. Provide sufficient details to permit placement of liner without use of design Drawings. Reproduction of design Drawings for use as shop drawings will not be allowed. Do not begin fabrication of liner until after shop drawings and submitted materials have been reviewed and accepted by Project Manager.

1.05 INSTALLER QUALIFICATIONS

A. Applicators. Application of plastic liner to forms and other surfaces, liner finishing, repair, and testing is considered highly specialized work and shall be performed only by firms and individuals recommended and approved by lining manufacturer. Personnel performing such work are to be trained in methods of installation and demonstrate their ability to Project Manager.

B. Welders.

1. Each welder is to pass qualification welding test before doing welding. Requalification may be required at time deemed necessary by Project Manager. Provide at least 24 hours notice to Project Manager to schedule qualification welding test.

2. Make test welds in presence of Project Manager. Test welds are to consist of following:

a. Begin with two pieces of liner, at least 15 inches long and 9 inches wide. Hold pieces in vertical position, lapped 1-1/2 inches.

b. Position weld strip over edge of lap and weld to both pieces of liner. Extend each end of weld strip at least 2 inches beyond liner to provide tabs.

3. The weld specimen will be tested as follows:

a. Subject each weld strip tab, tested separately, to 10-pound pull normal to face of liner with liner secured firmly in place. Weld is acceptable when there is no separation between weld strip and liner.

b. Cut three test specimens from welded sample and tested in tension across welds. Tensile strength measured across welded joints is to be at least 2000 psi when tested in

accordance with ASTM D 412. When none of these specimens fails when tested as indicated above, weld will be considered satisfactory.

c. If one specimen fails to pass tension test, retest will be permitted. Retest consists of testing three additional specimens cut from original welded sample. When three retest specimens pass test, weld will be considered satisfactory.

4. A disqualified welder may submit new weld sample when welder has had sufficient off-the-job training or experience to warrant re-examination.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic liner shall be as manufactured by Ameron Protective Linings Division; Poly-Tee, Inc.; or approved equal.

2.02 MATERIALS

A. Manufacturing.

1. Manufacture plastic liner sheet, joint, corner and weld strips from high molecular weight thermoplastic polymer compounded to make permanently flexible material suitable for use as protective liner in concrete pipe or other concrete structures. Polyvinyl chloride resin is to constitute not less than 99 percent by weight of resin used in formulation. Copolymer resins will not be permitted.

2. During manufacture or prior to final acceptance of Work, Project Manager may sample specimens taken from sheets, strips, or welded joints for testing.

3. Changes in formulation will be permitted only after prior notice is given to Project Manager and manufacturer demonstrates that new plastic liner will meet or exceed requirements for chemical resistance and physical properties.

B. Properties.

1. Plastic liner sheets including locking extensions, joints, corners, and welding strips are to be free of cracks, cleavages or other defects adversely affecting protective characteristics of material.

2. Except at shop welds, plastic liner sheets, joint, corner, and weld strips are to have the following properties when tested at 77 degrees F plus or minus 5 degrees F.

PROPERTY	ASTM TEST METHOD	CHEMICAL RESISTANCE TEST	
		INITIAL	AFTER CHEMICAL EXPOSURE (Note 1)
Tensile strength, min.	D 412, Die B	2200 psi	2100 psi
Elongation at break, min.	D 412, Die B	200 percent	200 percent
Shore durometer, Type D	D 2240, Within 1 sec.	50-60	±5 (Note 2)
	D 2240, 10 sec.	35-50	±5 (Note 2)
Weight change	(Note 3)	-----	±1.5% (Note 2)

Notes:
1. For 112 days in chemical solutions
2. With respect to initial test results
3. Specimen to be 1 inch x 3 inch sample sheet thickness, taken from sheet or strip prior to final acceptance of work.

2.03 MATERIAL TESTS

A. Material Properties. Test samples taken from sheets, joints or weld strips to determine material properties. Determine PVC tensile strength and elongation in accordance with ASTM D 412 using Die B. Determine indentation hardness in accordance with ASTM D 2240 using Type D durometer, except that single thickness of material will be used. Determination of change of weight and indentation hardness is to be made of 1-inch by 3-inch specimens. Thickness of specimens shall be thickness of sheet or strip.

B. Measurement of Initial Physical Properties. Determine initial values for tensile strength, weight, elongation and indentation hardness prior to chemical resistance tests.

C. Chemical Resistance Tests.

1. Determine physical properties of specimens after exposure to chemical solutions. Condition test specimens to constant weight at 110 degrees F before and after submersion in the following solutions for period of 112 days at 77 degrees F plus or minus 5 degrees F.

Chemical Solution	Concentration
Sulfuric acid	20%*
Sodium hydroxide	5%
Ammonium hydroxide	5%*
Nitric acid	1%*
Ferric chloride	1 %
Soap	0.1 %
Detergent (linear alkyl benzyl sulfonate or LAS)	0.1%
Bacteriological	BOD not less than 700 ppm

* Volumetric percentages of concentrated C.P. grade reagents.

2. At 28 day intervals, remove specimens from each chemical solution and test. When specimen fails to meet 112-day property requirements specified in paragraph 2.02B before completion of 112-day exposure, material will be rejected.

D. Pull Test for Locking Extensions. Liner locking extensions embedded in concrete are to withstand test pull of at least 100 pounds per linear inch, applied perpendicularly to concrete surface for period of 1 minute, without rupture of locking extensions or withdrawal from embedment. Perform this test at temperature between 70 degrees F and 80 degrees F, inclusive.

E. Shop-Welded Joints. Shop-welded joints used to fuse individual sections of liner together, are to meet minimum requirements of liner for thickness, corrosion resistance and impermeability. Welds shall show no cracks or separations and be tested for tensile strength. Tensile strength, measured across welded joint in accordance with ASTM D 412 using Die B, shall be at least 2000 psi. Test temperature is to be 77 degrees F plus or minus 5 degrees F and use measured minimum width and thickness of reduced test specimen section.

F. Spark Test. Shop and field test liners for holidays or flaws using an approved spark tester set to provide minimum of 20,000 volts (Tinker and Rasor Model AP-W with power pack, or approved equal). Satisfactorily repair sheets having holes in shop prior to shipment from manufacturer's plant. Repairs shall be made by welders qualified in accordance with these specifications.

2.04 MATERIAL DETAILS AND DIMENSIONS

A. Approval of Details. Liner sheet, strip, and other accessory pieces are to conform to requirements of these Specifications.

B. Thickness of Material. Minimum thickness of PVC sheet and strip shall be as follows:

Material	Thickness in Inches
Sheet, integral locking extensions	0.065
Sheet, plain	0.094
Joint strip	0.094
Weld strip	0.125

C. Material Sizes. Use pipe-size sheets for sheets of PVC liner to provide coverage required by Drawings. Structural sheets are to be standard 48-inches by 96-inches, with special size noted on shop drawings. Lengths specified shall include tolerance at ratio of plus or minus 1/4-inch for each 100 inches, or 0.25 percent. Joint strips shall be 4 inches plus or minus 0.25 inch in width and have each edge beveled prior to application. Weld strips shall be 1 inch plus or minus 0.125 inch in width. Weld strips are to have edges beveled at time of manufacture.

D. Locking Extensions.

1. No polygrip-type holding or locking extension will be permitted.

2. PVC liner to be embedded in concrete is to have integral locking extensions. Liner may not be bonded to concrete surfaces with adhesives except as specifically acceptable to Project Manager.

3. PVC locking extensions are to be same material as liner, be integrally molded or extruded with sheets, and have an approved cross section with minimum height of 0.375 inch and minimum web thickness of 0.085 inch. They are to be approximately 2.5 inches apart and be such that when extensions are embedded in concrete, liner will be held permanently in place.

4. PVC locking extensions are to be parallel and continuous except where interrupted for joint flaps, weep channels, strap channels and for other purposes shown on Drawings or permitted by Project Manager.

5. The liner sheet edge which will be lower terminal edge in structure is not to extend beyond base of final locking extension more than 0.375 inch.

E. Provisions for Strap Channels. Unless alternate methods are acceptable to Project Manager, liner required to be secured to inner form with straps

are to have strap channels at not more than 20 inches on center perpendicular to locking extensions. Strap channels are to be maximum of 1-inch wide and formed by removing locking extensions so that maximum of 3/16-inch remains. Channels are not to be provided in final two locking extensions adjacent to terminal edge of liner coverage.

F. Flaps. When transverse flaps are specified or required, fabricate by removing locking extensions so that no more than 1/32 inch of base of locking extensions remains on sheet.

G. Adhesive Products. Adhesive products and application procedures used in installation of liner are to be according to manufacturer's recommendations. Adhesive products intended for use inside cast-in-place structures are to be non-flammable.

H. Cleaners. Cleaners used in installation of liner shall be reviewed by Project Manager prior to use. Cleaners are to be nonflammable and water soluble or water dispersible and not be detrimental to plastic liner.

I. Caulking Products. Caulking products and application procedures used in installation of liner and appurtenances are to be as recommended by manufacturer.

J. Mechanical Anchors. When approved for use with plain sheet liner, provide anchors and washers of Type 316 stainless steel, and as recommended by liner manufacturer.

PART 3 EXECUTION

3.01 NOTIFICATION

A. Notify Project Manager at least 24 hours before reinforcing steel placement so that lining maybe inspected and errors corrected without delaying Work.

3.02 PLACING LINER

A. Location. Place liner throughout entire length of interceptor sewer along top 300 degrees of pipe circumference, and inside structures as indicated on Drawings. Liner is to be applied and secured to forms and inspected by Project Manager prior to placement of reinforcing steel.

B. Coverage.

1. In cast-in-place structures, no offset of lower terminal edge is permitted. Unless otherwise shown on Drawings, lower terminal

edge is to be one foot below low water level (“all pumps off” level for lift stations), or 6 inches below top of grout or concrete fillet, whichever is higher.

2. At station where there is difference in pipe's circumferential liner coverage, as shown on Drawings, and longitudinal terminal edges of liner downstream from that station are lower than those upstream, uniformly slope terminal edges of liner installed in section of pipe or structure immediately upstream from station for entire length of section of pipe or structure from limits of smaller coverage to those of greater coverage. Wherever longitudinal terminal edges of liner downstream from station are higher than those upstream, accomplish slope uniformly throughout length of section of pipe or structure immediately downstream from station. Provide an approved locking extension along sloping lower terminal edges of liner plate.

C. Positioning Liner.

1. Position PVC liner installed in pipe so that locking extensions are parallel to longitudinal axis of pipe.

2. Position PVC liner installed in cast-in-place structures so that locking extensions are parallel to direction of concrete placement, which is normally vertically for vertical walls.

3. Closely fit liner to inner forms. Cut sheets to fit curved and warped surfaces using minimum number of separate pieces.

4. The Project Manager may require use of patterns or marking of sheet layouts directly on forms where complicated warped surfaces are involved.

5. At transverse joints between sheets of liner used in cast-in-place structures and pipe joints, space between ends of locking extensions, measured longitudinally, shall not exceed 4 inches. Where sheets are cut and joined for purpose of fitting irregular surfaces, this space shall not exceed 2 inches.

D. Securing Liner in Place.

1. Liner shall be held snugly in place against inner forms. For pipes and similar circular sections, use light steel banding straps or other approved means. Prefabricated pipe-size tubular sheets which do not require strap channels may also be used.

2. When used, place banding straps in strap channels, as specified under provision for strap channels, at spacing not to exceed 20 inches.

3. Any method of banding, other than in strap channels, shall be reviewed by Project Manager prior to use.

4. On vertical surfaces where form ties or form stabilizing rods pass through liner, make provisions to maintain liner in close contact with forms during concrete placement. These provisions shall be reviewed by Project Manager.

5. Prevent concrete from flowing around edges of sheets at joints by sealing joint or seam with waterproof tape recommended by manufacturer.

6. Forms in contact with plastic liner need not be oiled.

E. Weep Channels.

1. At each pipe joint and at transverse joints in cast-in-place structures, gap not less than 2-inches nor greater than 4 inches shall be left in locking extensions to provide transverse weep channel. When locking extensions are removed to provide weep channel at joints, base of extension left on sheet shall not exceed 3/16 inch.

2. Provide intermediate weep channels as required to maintain maximum spacing of 8 feet. Intermediate weep channels shall not be less than 2.0 inches nor greater than 4.0 inches in width. When locking extensions are removed to provide intermediate weep channels, base of extension left on sheet shall not exceed 3/16 inch.

3. Any area behind liner, which is not properly served by regular weep channels, shall have additional weep channels 2 inches wide provided by cutting away locking extensions.

4. Provide transverse weep channel approximately 12 inches away from each liner return where surfaces lined with plastic liner join surfaces which are not so lined.

5. As part of work of installing liner, clear outlets of weep channels of obstructions which would interfere with their proper functions.

6. Design weep channels for external hydrostatic pressures of water column equal in height to greater of 50 feet (22 psi) or 1.1 times depth of burial.

F. Liner Returns.

1. Install liner return where shown on approved shop drawings and wherever surfaces lined with plastic liner joins surfaces which are not so lined.

2. Unless otherwise indicated by Drawings or approved shop drawings showing liner installation methods, make returns as follows:

a. Return liner at least 3 inches at surfaces of contact between concrete structure and items not concrete (including access frames, gate guides and pipe penetrations).

b. Follow the same procedure at joints where type of protective lining is changed, or new work is built to join existing unlined concrete.

3. Provide locking extensions on returns to lock returns to concrete of plastic-lined, cast-in-place structures.

4. Seal each liner return to adjacent construction with which it is in contact by means of an adhesive system recommended by manufacturer and acceptable to Project Manager. When joint space is too wide or joint surfaces too rough to permit use of compound, fill joint space with 2 inches of densely caulked cement mortar, lead wool, or other caulking material and finished with minimum of 1 inch depth of an approved corrosion resistant sealant material.

3.03 CONCRETING OPERATIONS

A. Concrete Placement.

1. Carefully vibrate concrete placed against liner shall be so as to avoid damage to liner and to produce dense concrete securely anchoring locking extensions into concrete. Use external vibrators in addition to internal vibrators, particularly along lower terminal edge of liner.

2. Stiffeners, when used along locking extensions of liner installed in forms for pipe, shall be withdrawn completely during placement of

concrete in forms. Re-vibrate concrete to consolidate concrete in void spaces caused by withdrawal of stiffeners.

B. Removing Forms.

1. In removing forms, take care to protect liner from damage. Do not use sharp instruments to pry forms from lined surfaces. When forms are removed, pull nails that remain in liner plate without tearing liner and clearly mark resulting holes. Mark form tie holes before ties are broken off. Mark areas of abrasion of liner.

2. Following completion of form removal, clean liner in pipe and structures for inspection.

3. Remove banding straps used in securing liner to forms for pipe and cast-in-place structures within limits of unlined invert.

3.04 FIELD JOINTING OF LINER

A. Installation Requirements.

1. No field joint shall be made in liner until lined pipe or structure has been backfilled and 7 days have elapsed after flooding or jetting has been completed. Where ground water is encountered, joint shall not be made until pumping of ground water has been discontinued for at least 7 days and no visible leakage is evident at joint. Liner at joints shall be free of mortar and other foreign material and be clean and dry before joints are made.

2. Hot joint compound shall not be brought in contact with liner.

3. No coating shall be applied over joint, corner or welding strip, except where nonskid coating is applied to liner surfaces.

B. Field Joints in Pipe Installation.

1. Field joints in lining at pipe joints shall be one of the following types:

a. Type P-1. Make joint with separate 4-inch joint strip and two welding strips. Center 4-inch joint strip over joint, heat-sealed to lining, then welded along each edge to adjacent liner sheets with 1-inch weld strip. 4-inch joint strip shall lap over each sheet minimum of 1/2 inch.

b. Type P-2

(1) Make joint with joint flap with locking extensions removed as described in paragraph 2.04 above, and extending approximately 4 inches beyond pipe end. Joint flap shall overlap lining in adjacent pipe section minimum of 1/2 inch and be heat-sealed in place prior to welding. Complete field joint by welding flap to lining of adjacent pipe using 1-inch weld strip.

(2) Take care to protect flap from damage. Avoid excessive tension and distortion in bending back flap to expose pipe joint during laying and joint mortaring. At temperatures below 50 degrees F heating of liner may be required to avoid damage.

2. Do not make field joints in liner at pipe joints until mortar in pipe joint, when used, has been allowed to cure for at least 48 hours.

3. Joints between lined pipe and lined structures are to be either Type C-1 joint or Type C-2 joint as described below.

C. Field Joints in Concrete Structures. Field joints in liner on concrete structures are to be one of following types:

1. Type C-1. Make joint with separate 4-inch joint strip and two welding strips. Center 4-inch joint strip over joint, heat-sealed to liner, then welded along each edge to adjacent sheets with 1-inch wide weld strip. Width of space between adjacent sheets is not to exceed 2 inches. 4-inch joint strip is to lap over each sheet minimum of 1/2 inch. It may be used at transverse or longitudinal joint.

2. Type C-2. Make joint by lapping sheets not less than 1/2 inch. One 1-inch weld strip is required. Upstream sheet is to overlap one downstream. Heat-seal lap into place prior to welding on 1-inch weld strip.

3. Type C-3. Make joint by applying 2-inch wide waterproof tape or 1-inch wide welding strip on back of maximum 1/4-inch gap butt joint or by some other method approved by Project Manager to prevent wet concrete from getting under sheet. After forms have been stripped, apply 1-inch weld strip over face to sheet.

D. Installation of Welding Strips.

1. All welding of joints is to be in strict conformance with specifications and instructions of lining manufacturer.

2. Welding is to fuse both sheets and weld strip together to provide continuous joint equal in corrosion resistance and impermeability to liner plate.

3. Hot-air welding tools shall provide effluent air to sheets to be joined at temperature between 500 degrees F and 600 degrees F. Hold welding tools approximately 1/2 inch from and moved back and forth over junction of two materials to be joined. Move welding tool slowly enough as weld progresses to cause small bead of molten material to be visible along both edges and in front of weld strip.

4. Maintain adequate ventilation in confined spaces during welding operations.

5. After repairs have been made, defective welds will be re-inspected and re-tested.

E. Joint Reinforcement. Apply 12-inch long welding strip as reinforcement across each transverse joint and weep channel which extends to lower terminal edge of liner. Center reinforcement strips over joint being reinforced and located as close to lower edge of liner as practicable. Weld in place after transverse welding strips have been installed.

F. Application of Liner to Concrete Surfaces with Adhesives. Application of liner plate to concrete surfaces by means of adhesive is allowed only where shown on Drawings for existing structures, or where specifically acceptable to Project Manager and called out on approved shop drawings, and is to be accomplished by following steps:

1. Etch concrete surface by abrasive blasting to develop slightly granular surface.

2. After abrasive blasting, thoroughly clean concrete surface of dust.

3. Apply primer, adhesive and liner in strict accordance with manufacturer's recommendations, as approved by Project Manager.

4. Place mechanical anchors at 12-inch centers each way after adherence of liner to concrete surface has been achieved. Place anchors after adhesive system has cured for minimum of 24 hours. Seal penetration of liner by anchor in accordance with manufacturer's recommendations.

G. Nonskid Surfaces. Surfaces of liner, shown on Drawings to be nonskid, treated as follows prior to installation:

1. Liner is to be cleaned, dried, and spread with an adhesive coating recommended by manufacturer of liner plate.

2. Liberally sprinkle surface with clean, dry, well graded sand, which will pass No. 30 sieve but be retained on No. 70 sieve.

3. After sanded surface has thoroughly dried, brush away excess sand and spray seal coat of adhesive coating over sand in sufficient quantity to coat and bond sand to liner plate.

4. Allow coated sand surface to dry thoroughly before handling.

H. Protection and Repair of Liner.

1. Take necessary measures and precautions to prevent damage to liner from equipment and materials used in or taken through Work. Repair damage to installed liner plate in accordance with requirements for repair of liner.

2. Patch nail and tie holes and cut, torn and seriously abraded areas in liner plate. Patches made entirely with welding strip are to be fused to liner over entire patch. Use of this method is limited to patches which can be made with single welding strip. Use of parallel, overlapping or adjoining welding strips will not be permitted. Larger patches may consist of smooth liner over damaged area, with edges covered with welding strips fused to patch and to liner adjoining damaged area. Limit size of single patch of latter type only as to its width, which shall not exceed 4 inches.

3. Whenever liner is not properly anchored to concrete, or whenever patches larger than those permitted above are necessary, accomplish repair of liner and restoration of anchorage by injecting epoxy grout behind liner plate by method approved by Project Manager. Use of adhesives will not be allowed to repair improperly anchored liner plate.

I. Field Tests.

1. Upon completion of installation, clean surface of liner to permit visual inspection and spark testing by Project Manager, using spark-type detector complying with requirements for Spark Test. Properly repair and retest areas of liner failing to meet field test.

2. Contractor is to assist in inspection and spark testing by providing adequate ventilation, ladders for access, barricades or other traffic control devices, and is responsible for opening and closing entrances and exits.

3. Spark testing of liner by Contractor is to be done with detector complying with these Specifications.

END OF SECTION

SECTION 02447

AUGERING PIPE AND CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installing water service pipe by methods of augering or casing by jacking and boring.

B. Installing Telecommunication Conduit along or under Public Ways

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for augering pipe for water lines under this Section. Include payment in unit price for Section 02511 - Water Lines.

2. When open-cut construction is requested by Contractor for his convenience in areas designated for augering, and when approved in advance by Public Works, such areas shall be paid for at Unit Price for Section 02511 - Water Lines.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Auger Method: Installation of steel casing by excavating soil at advancing end of casing and transporting spoil through casing by otherwise uncased auger, while advancing casing by jacking at same rate as auger excavation progresses.

B. Slurry Auger Method: Installation of casing or pipe by first drilling small diameter pilot hole from pit to pit, followed by removing excess soil and installing pipe or conduit by pull-back or jacking method.

1.04 REFERENCE STANDARDS

A. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

B. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edgewise Position.

C. ASTM D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.

D. ASTM D 790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.05 REGULATORY REQUIREMENTS

A. Conform to TxDOT for installations under state highways. The City will obtain required permits for State Highway crossings.

B. Installations Under Railroads:

1. Secure and comply with requirements of right-of-entry for crossing Railroad Company's easement or right-of-way from railroad companies affected. Comply with railroad permit requirements.

2. Use auger method only.

3. Damages due to delays caused by railroad requesting work to be done at hours which will not inconvenience railroad will be at no additional cost to the City.

4. Maintain equipment and excavations minimum 35-Ft. clearance from centerline of tracks or as required by RR permit.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for casing insulators, spacing of insulators for specific pipe and location on project.

C. Prior to installation of pits obtain Public Works approval for pit locations, size, depth, and areas for storage, material, and spoil handling. Acceptance of Public Works does not relieve Contractor from responsibility to obtain specified results.

D. Show actual pit locations dimensioned on as-built drawings so that they can be identified in field.

E. Submit copy of executed railroad company rights of entry to Public Works.

1.07 CRITERIA FOR SELECTION OF MATERIAL

A. Contractor shall be responsible for selection of casing, pipe, and pipe joints to carry anticipated thrust of jacks or loads.

PART 2 PRODUCTS

2.01 MATERIALS

A. Piping and Fittings: As required by Specification or Drawings.

B. Casings: Where shown on Drawings, in accordance with Section 02502 - Steel Pipe and Fittings.

C. Casing Spacers: Where casings are shown on Drawings, use casing spacer width 8-In. for pipe sizes 4 to 12-In.; 12-In. for pipe sizes 14-In. and larger. Wood skids or concrete "donuts" are not acceptable.

1. For welded steel pipe 12-In. and smaller, use Pipeline Seal & Insulator Model PE, or approved equal.

2. For other pipe materials, use Pipeline Seal & Insulator Model C8G-2 or approved equal for pipe sizes up to 12-In.

3. For all pipe sizes above 12-In., use Pipeline Seal & Insulator Model C12G-2 or approved equal.

4. Obtain approval for equal product in writing from Public Works prior to bid.

5. Use ISO-9002 registered casing spacer manufacturer or supplier. Submit copy of current certificate with submittal package.

D. Casing End Seals: Provide Pipeline Seal and Insulator Model C, or approved equal.

E. Casing Spacers (For Pipes Diameters 16-In. or Greater): Bolt-on style with shell made of two sections of 14-gauge carbon steel, hot rolled, cleaned, and lined with PVC liner, 0.090-In. thick with Durometer A 85-90 overlapping edges to secure liner to spacer; deep embossed flanges for added strength; coated prior to installation of liner and runner with fusion-bonded PVC powder of 14 to 20 mils thickness; electroplated studs, nuts, and washers.

1. Runners (For Pipe Diameters 16-In. or Greater): Supported by 10-gauge carbon steel MIG risers welded to shell. Total length of weld beads shall be at least 50 percent of the length of the runner. Fill bolt

holes with caulk or approved equal to provide a water-tight seal. Minimum requirements: Glass reinforced plastic conforming to the following tests:

a. Tensile Strength: ASTM D 638; 17,600 psi

b. Flexural Strength: ASTM D 790; 25,300 psi

c. Compression Strength: ASTM D 695; 18,000 psi

d. Deflection Temperature at 264 psi: ASTM D 648; 405 F

e. Polyethylene runners are not acceptable

PART 3 EXECUTION

3.01 LIMITS ON AUGER LENGTH WITHOUT CASING

A. Do not exceed 100-Ft. for length of auger hole without receiving pit.

B. Do not exceed 75-Ft. for length of auger hole for PVC pipe 12-In. and less in diameter without receiving pit.

C. Do not exceed 40-Ft. for length of auger hole for PVC pipe 14-In. to 24 –In. in diameter without receiving pit.

3.02 PREPARATION

A. Conform to applicable provisions of Section 02233 - Clearing and Grubbing.

B. Utility Relocations: Relocate utility lines clear of pit and zone of potential significant settlement or other ground disturbance.

C. Install casings as required by Drawings, in accordance with this Section.

D. Install temporary solid plug at open end of water line to prevent contamination.

3.03 TRAFFIC CONTROL

A. Conform to applicable provisions of Section 01555 - Traffic Control and Regulation.

B. Secure right-of-entry for crossing Railroad Company’s easement or right-of-way.

C. During construction operations, furnish, and maintain barricades and lights

to safeguard traffic and pedestrians, until such time as backfill has been completed and removed from site. Provide additional barricades and lights as directed by Public Works.

3.04 PITS

A. Construct pits on segments of line and within right-of-way. Locate auger pits where there is minimum interference with traffic or access to property. Avoid locating pits close to storm drainage channels, ditches, storm water lines, culverts, or near potentially contaminated areas.

B. Pit Size: Size pits to provide adequate room to meet operational requirements for auger construction as well as structures indicated on Drawings. Provide minimum 6-In. space between pipe and walls of auger pit. Maximum allowable width of pit shall be 5-Ft.. Width of pit at surface shall not be less than at bottom. Maximum allowable length of pit shall be no more than 5-Ft. longer than one full section of pipe and shall not exceed 25-Ft.

C. Excavate bore pits to finished grade at least 6-In. lower than grade indicated by stakes.

D. Backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

E. Auger pits that are excavated and backfilled as part of open-cut water line construction shall be in accordance with Section 02317 - Excavation and Backfill for Utilities.

F. Provide and properly maintain safety protection against traffic, and accidental or unauthorized entry. Provisions to include concrete traffic barriers or other suitable barrier around periphery of pit as appropriate. Fully cover and secure pits where no construction activity is in progress.

G. Install sheeting, lining, shoring, and bracing required for protection of workmen and public in accordance with Section 02260 - Trench Safety Systems.

H. Provide groundwater control and drainage from pits while work is in progress and until pit is properly backfilled. Conform to requirements of Section 01578 - Control of Groundwater and Surface Water.

3.05 AUGERING (BORING)

A. Auger from approved pit locations. Excavate for pits and install shoring as outlined above under Paragraph 3.04, Pits. Auger mechanically with use of

pilot hole entire length of crossing and check for line and grade. Diameter of auger hole not to exceed pipe bell diameter plus 2-In.. Place excavated material outside working pit and dispose of as specified. Use water or other fluids in connection with boring operation only to lubricate cuttings; jetting is not permitted.

B. In unconsolidated soil formations, gel-forming colloidal drilling fluid may be used. Fluid is to consist of at least 10 percent of high-grade processed bentonite and shall consolidate cuttings of bit, seal walls of hole, and shall furnish lubrication for subsequent removal of cuttings and installation of pipe.

C. Depending on character of soil encountered during augering operation, conduct operations without interruption, insofar as practical, to prevent hole from collapsing or pipe from seizing up in hole before installation is complete.

D. Allowable variation from line and grade shall be as specified under Paragraph 3.08, Jacking.

E. Remove and replace pipe damaged in augering operations.

3.06 AUGERING OF CASING

A. Provide jacks, mounted on frame or against backstop, of capacity suitable for forcing excavating auger and casing through soil conditions to be encountered. Operate jacks so that even pressure is applied to casing.

B. Provide steerable front section of casing to allow vertical grade adjustments. Provide water level or other means to allow monitoring of grade elevation of auger casing.

C. Bentonite slurry may be used to lubricate casing during installation. Use of water to facilitate removal of spoil and to lubricate exterior casing is permitted; however, water jetting for excavation of soil is not allowed when jacking casing.

D. Tolerances from lines and grades shown on Drawings for gravity sewer pipe installed in casing are plus or minus 6 inches in horizontal alignment, and plus or minus 1 1/2-In. in elevation.

3.07 FILLING ANNULAR SPACE

A. For installation of water line, block void space around pipe in augered hole with approximately 12-In. of packed clay or approved equal material to prevent bedding or backfill from entering void around pipe in augered hole

when compacted. For pipe diameters 4-In. through 8-In. use minimum 1/2-Cu.-Ft. clay; for pipe diameters 12-In. through 16-In. use minimum 3/4-Cu.-Ft. clay.

3.08 JACKING

A. Comply with Section 02260 – Trench Safety for all pits, end trenches, and other excavations relating to work required by specifications. Dewater as required to provide safe working conditions.

B. Wherever end trenches are cut into sides of embankment or beyond it, sheath securely and brace such work to prevent earth caving.

C. Make up only one joint at time in pit or trench prior to jacking.

D. Do not interfere with operation of railroad, street, highway, or other facility, nor to weaken or damage embankment or structure.

E. Use heavy-duty jacks sized for forcing casing through embankment. Use appropriate jacking head, usually of timber, and bracing between jacks and jacking head and jacking frame or backstop. Apply jacking pressure uniformly around ring of casing. Set casing to be jacked on guides, properly braced together, to support section of casing and to direct it in proper line and grade. Place jacking assembly in line with direction and grade of casing. Excavate embankment material just ahead of casing and remove material through casing. Force casing through embankment with jacks into excavated auger hole.

F. Conform excavation for underside of casing to contour and grade of casing, for at least one third of circumference of casing. Provide clearance of not more than 2-In. for upper half of casing. Taper off upper clearance to zero at point where excavation conforms to contour of casing.

G. Excavation may extend beyond end of casing depending on character of material, but shall not exceed 2-Ft.. Decrease advance excavation at direction of Public Works, when character of material being excavated makes it desirable to keep advance excavation closer to end of casing.

H. Jack casing from low or downstream end. Lateral or vertical variation in final position of casing from line and grade as shown on Drawings will be permitted only to extent of 1-In. in 10-Ft., provided such variation is regular and only in one direction and that final grade of flow line is in direction indicated on Drawings.

I. Use cutting edge of steel plate around head end of casing extending short distance beyond end of casing with inside angles or lugs to keep cutting

edge from slipping back onto casing.

J. Once jacking of casing is begun, carry on without interruption, insofar as practicable, to prevent casing from becoming firmly set in embankment.

K. Remove and replace casing damaged in jacking operations.

L. Backfill pits or trenches excavated to facilitate jacking operations immediately after completion of jacking of casing.

M. Grout annular space between casing and excavated hole when loss of embankment occurs or when clearance of 2-In. is exceeded.

3.09 SPACER INSTALLATION

A. There must be no inadvertent metallic contact between casing and carrier pipe. Place spacers to ensure that carrier pipe is adequately supported throughout length, particularly at ends, to offset settling, and possible electrical shorting unless otherwise approved by the City. Place end spacer within 6-In. of end of casing pipe, regardless of size of casing and carrier pipe or type of spacer used. Spacing between spacers depends largely on load bearing capabilities of pipe coating and flexibility of pipe.

B. Grade bottom of trench adjacent to each end of casing to provide firm, uniform, and continuous support for carrier pipe. When trench requires some backfill to establish final trench bottom grade, place backfill material in 6-In. lifts and compact to density of undisturbed soil.

C. Install casing spacers in accordance with manufacturer's instructions. Take special care to ensure that sub-components are correctly assembled and evenly tightened, and that no damage occurs during tightening of insulators or carrier pipe insertion.

D. Seal annulus between carrier pipe and casing with casing end seals at each end of casing.

E. Insulator Spacing:

1. Spacing shall be as shown on Drawing with maximum distance between spacers to be 10-Ft. for pipe sizes 4 to 14-In. and 8-Ft. for pipe sizes 16 to 30-In.

2. For ductile iron pipe or bell-and-spigot pipe, install spacers within 1-Ft. on each side of bell or flange and one in center of joint when 18- to 20-Ft. long joints are used.

3. If casing or carrier pipe is angled, bent, or dented, reduce spacing as directed by Public Works. Provide casing with smooth, continuous interior surface.

3.10 SETTLEMENT MONITORING

A. Monitor ground surface elevation along length of augering operation. Locate and record settlement monitoring points with respect to construction baseline and elevations. Record elevations to accuracy of 0.01-Ft. for each monitoring point location.

1. Railroads: Track subbase at centerline of each track.

2. Product pipelines: Directly above and 10-Ft. before and after pipeline intersection

B. Reading Frequency and Reporting. Take settlement survey readings:

1. Prior to auger excavation reaching point

2. After auger reaches monitoring point in plan

3. After grouting of ground supporting casing is complete

C. Immediately report to Public Works movement, cracking, or settlement which is detected.

D. Following substantial completion but prior to final completion, make final survey of monitoring points.

3.11 DISPOSAL OF EXCESS MATERIAL

A. Conform to applicable provisions of Section 01576 - Waste Material Disposal.

END OF SECTION

SECTION 02448

PIPE AND CASING AUGERING FOR SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of casing for sewer pipe by dry augering or slurry boring methods, together with installation of sewer pipe in casing.

B. Installation of sewer pipe by slurry boring methods. Construction casing may be used at Contractor's option.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Casing, including sewer pipe, installed by augering methods in mid-run of open cut segments where shown on Drawings, will be measured and paid by linear foot from end to end of casing. Casing may be installed, at Contractor's option, at locations other than shown on Drawings, at no additional cost to the City.

2. Sewer pipe installed by augering method in mid-run of open-cut segments where shown on Drawings, will be measured and paid by linear foot from end to end of augered section.

3. Pipe or casing segments installed by augering methods in locations other than mid-run of open cut segments and shown on Drawings, will be measured and paid by linear foot along centerline of completed sewer from centerline to centerline of manholes to ends of stubs or termination of pipe, and to inside face of lift stations and other structures.

4. Payment will include and be full compensation for labor, equipment, materials and supervision for excavation and construction of sewer, complete in place including disposal of excess materials, shoring, dewatering, utility adjustments, grouting, backfill, clean-up, and other related work necessary for construction as indicated on Drawings and specified in this Section.

5. Cost for pits and other excavations are included in unit price for pipe with or without casing.

6. Trench safety systems for pits are paid as specified in Section 02260 - Trench Safety Systems.

7. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Augering means either “dry augering” or “slurry augering”.

B. Dry augering is jacking casing while excavating soil at heading and transporting spoil back through casing by otherwise uncased auger.

C. Slurry Auger Method: Installation of casing or pipe by first drilling small diameter pilot hole from shaft to shaft, followed by removing excess soil and installing pipe or conduit by pull back or jacking method.

1.04 REFERENCE STANDARDS

A. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

B. American Association of State Highway and Transportation Officials (AASHTO).

1.05 REGULATORY REQUIREMENTS

A. Conform to Texas Department of Transportation requirements for installations under state highways. The City will obtain required permits for State Highway crossings.

B. Installations under Railroads:

1. Secure and comply with requirements of right-of-entry for crossing railroad company's easement or right-of-way from railroad companies affected. Comply with railroad permit requirements.

2. Use dry auger method only.

3. Damages due to delays caused by railroad requesting work to be done at hours which will not inconvenience the railroad will be at no additional cost to the City.

4. Maintain minimum 35-Ft. clearance from centerline of tracks.

1.06 SUBMITTAL

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. For installation by augering, submit for review:

1. Description of mechanized excavating equipment.

2. Method of controlling line and grade.

3. Grouting techniques to be used for filling annular void between sewer pipe and casing, and void between sewer pipe or casing and ground, including equipment, pumping and injection procedures, pressure grout types, and mixes.

4. Locations and dimensions of pits.

5. Pit design and construction drawings.

6. Identification of casings required and paid under Contract and casings installed at Contractor's option.

7. Design of casings.

8. Copy of railroad company permits and right-of-entry.

C. Prepare auger pit and casing design submittals that are site specific. Have auger pit and casing design submittals signed and sealed by qualified Professional Engineer registered in the State of Texas.

D. Include in construction phase submittals:

1. Daily logs of augering and boring operations.

2. Settlement monitoring data to meet requirements of paragraph 3.05, Settlement Monitoring.

3. Submit daily logs and settlement monitoring data within 5 days after day of observation.

1.07 CRITERIA FOR DETERMINING CASING INSTALLATION LOADS

A. Select and design casing pipe and pipe joints to carry thrust of jacks or loads due to pulling mechanism in combination with overburden, earth and hydrostatic loads. Select casings for dry augering to withstand action of auger without damage.

B. Use Professional Engineer to determine design stresses, design deflections and factors of safety for design of casing. Present such

determination as part of design submittal. Apply the following maximum casing pipe stresses and deflections to casings shown on Drawings:

1. Design stress in pipe wall: 50 percent of minimum yield point of steel or 18,000 psi, whichever is less, when subjected to applicable loading conditions.

2. Wall thickness: Maximum allowable deflection which does not exceed 3 percent of nominal casing diameter.

C. Use Cooper E-80 locomotive loading distributions as criteria for railroad crossings in accordance with AREMA specifications for culverts. In design, account for additive loadings due to multiple tracks.

D. Use H-20 vehicle loading distributions as criteria for truck loading in accordance with AASHTO.

E. When not specifically indicated on Drawings, select casing diameter to permit practical installation (including skids when applicable) and grouting.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide casing pipe which is straight, circular in section, uncoated, welded steel pipe, in accordance with Section 02502 - Steel Pipe and Fittings.

B. Provide sewer pipe in accordance with Section 02531 - Gravity Sanitary Sewers. Do not use high density polyethylene pipe for augering.

C. Provide restrained-joint sewer pipe when installing sewer pipe in slurry bored holes by pull- back method.

D. Supply grout as specified in Section 02431 - Tunnel Grout.

PART 3 EXECUTION

3.01 LOCATION AND SIZE OF AUGER PITS

A. Show location of auger pits on auger pit construction drawings. Locate auger pits for slurry boring so that distance between pits is no greater than 80-Ft.; and for dry augering not more than 120-Ft. apart.

B. Locate auger pits and associated work areas to avoid blocking driveways and cross streets and to minimize disruption to business and commercial

interests. Avoid auger pit locations near areas identified as potentially contaminated.

C. Make size adequate for construction of structures indicated on Drawings. Provide adequate room to meet Contractor's operational requirements for augering.

D. Provide portable concrete traffic barrier around periphery of pit, meeting applicable safety standards. Properly maintain barrier throughout period pit remains open. Angle traffic barriers in direction of lane flow; do not place barriers perpendicular to on-coming traffic.

E. Provide full cover or other security fencing for each access pit in which there is no construction activity or which is unattended by Contractor's personnel.

3.02 DRY AUGERING OF CASING

A. Provide jacks, mounted on frame or against backstop, of capacity suitable for forcing excavating auger and casing through soil conditions to be encountered. Operate jacks so that even pressure is applied to casing.

B. Provide steerable front section of casing to allow vertical grade adjustments. Provide water level or other means to allow monitoring of grade elevation of auger casing.

C. Bentonite slurry may be used to lubricate casing during installation. Use of water to facilitate removal of spoil is permitted; however, water jetting for excavation of soil is not allowed when jacking casing.

D. Tolerances from lines and grades shown on Drawings for gravity sewer pipe installed in casing are plus or minus 6-In. in horizontal alignment, and plus or minus 1 1/2-In. in elevation.

3.03 SLURRY BORING OF CASING OR PIPE

A. Drill small diameter pilot hole and check for line and grade at receiving end. Redrill pilot hole when bored pipe does not meet specified tolerances.

B. Using pilot hole as guide bore larger diameter hole of sufficient size for pipe or casing installation. Water jetting is not permitted.

C. Bentonite slurry may be used to maintain stable hole and furnish lubrication for pipe or casing installation.

D. Tolerances from lines and grades shown on Drawings for installed sewer pipe are plus or minus 6-In. in horizontal alignment and plus or minus 1 1/2-In. in elevation.

E. Completely fill annular space between sewer pipe and surrounding soil or casing with grout, without displacing pipe during grouting operation.

3.04 SEWER PIPE IN CASING

A. If indicated on plans, grout annular void between sewer pipe and casing from end to end of casing. Block and brace sewer pipe to prevent movement during grout placement and to maintain specified line and grade. Grout as specified in Section 02431 - Tunnel Grout.

3.05 SETTLEMENT MONITORING

A. Monitor ground surface elevation along length of augering operation. Locate and record settlement monitoring points with respect to construction baseline and elevations. Record elevations to accuracy of 0.01-Ft. for each monitoring point location. Establish monitoring points at locations and by methods that protect them from damage by construction operations, tampering, or other external influences. As minimum, locate survey points as follows:

1. For road crossings: Centerline and each shoulder

2. Railroads: Track subbase at centerline of each track

3. Utilities and Pipelines: Directly above and 10-Ft. before and after utility or pipeline intersection

4. Long bores under improved areas such as pavements: Ground surface elevations must be recorded on centerline ahead of augering operations at locations not to exceed 50-Ft. apart (including points located for roads, railroads, utilities, and pipelines), or at least three locations per augering drive

B. Reading Frequency and Reporting. Take settlement survey readings:

1. Prior to auger excavation reaching point

2. After auger reaches monitoring point in plan

3. After grouting of ground supporting pipe or casing is complete

C. Immediately report to Public Works movement, cracking, or

settlement which is detected.

D. Following substantial completion but prior to final completion, make final survey of monitoring points.

3.06 DISPOSAL OF EXCESS MATERIAL

A. Remove and dispose of spoil from job site in accordance with Section 01576 - Waste Material Disposal.

3.07 LEAKAGE TESTING

A. Test sanitary sewers for leakage by low pressure air methods in accordance with Section 02533 - Acceptance Testing for Sanitary Sewer.

END OF SECTION

SECTION 02465

DRILLED SHAFT FOUNDATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of foundations consisting of reinforced concrete drilled shafts.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for drilled shaft foundations under this Section. Include cost in lump sum payment for structure requiring drilled shaft foundations.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit work plan for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to drilled shaft activities. Descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to Public Works that procedures meet requirements of Specifications and Drawings.

C. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record locations of drilled shafts, as installed referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.04 REFERENCE STANDARDS

A. ACI 336.1 - Standard Specification for Construction of Drilled Piers

B. TxDOT Standard Specification Item 416 - Drilled Shaft Foundations

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Perform excavation with equipment suitable for achieving requirements of this Specification.

2.02 MATERIAL

A. For cast-in-place concrete, use Class A concrete. Refer to Section 03310 – Structural Concrete.

B. For reinforcing steel, refer to Section 03211 - Reinforcing Steel

PART 3 EXECUTION

3.01 PREPARATION

A. Conduct an inspection to determine condition and locations of existing structures and other permanent installations, prior to commencing work.

3.02 EXCAVATION

A. Perform excavation required for drilled cylindrical shafts, at locations shown on Drawings through whatever materials encountered, to dimensions and elevations shown or required by site conditions. When satisfactory material is not encountered at plan depth, bottom of shaft will be adjusted or foundation altered, as determined by Public Works, to satisfactorily comply with design requirements.

B. Do not make shaft excavations within 3 shaft diameters (edge to edge) of shafts which have been concreted within previous 24 hours.

C. Inspect drilled shaft excavations for verticality and side sloughing. Verticality is specified at one inch in 10-Ft. of shaft length. Check to full depth of dry auguring prior to introducing drilling mud. Straighten or add suitable reinforcing steel to shafts not meeting specified tolerance.

D. Slurry is to contain 4 to 8 percent by weight of Bentonite additive and satisfy slurry specifications set forth in ACI 336.1, Section 2.3.5.2e. These requirements are more stringent than TxDOT Standard Specification Item 416.3.1. Stricter slurry specifications are required to assure suspension of detritus from drilling operations, and to ensure adequate cleaning of slurry prior to concreting. Cleaning of slurry is important to prevent deposition of detritus on reinforcement cages and ensure that inclusions of detritus will not be formed within concrete mass.

E. At final bearing elevation, clean bottom of each shaft and remove seepage water for examination by Public Works before reinforcing steel and concrete is placed. Suitable access and lighting for proper inspection of completed excavation is to be provided. Reinforcing steel and concrete is to be placed in drilled shaft without delay after approval of excavation by Public Works.

3.03 DRILLED SHAFT CONSTRUCTION

A. Drilled shaft construction and installation is to follow TxDOT Standard Specification Item 416 (with exceptions noted below) and ACI 336.1.

B. Before placing concrete, clean out shaft bottom with drilling bucket in order to remove sediments which may not be displaced by concrete. Clean shaft bottom with “clean-out” bucket until rotation on bottom without crowd (i.e., penetration under force) produces little spoil. Probing after cleaning out is essential to verify condition of base of shaft.

C. Concrete is to conform to requirements of ACI 336.1 Section 2.3.5.5.

D. Concrete is to be placed continuously in shaft to construction joint indicated on Drawings or as directed in TxDOT Standard Specification Item 416.3.3. Concrete is to be placed through suitable tube or tremie to prevent segregation of materials. Tremie pipe diameter is to be at least 8 times as large as largest concrete aggregate size.

E. Computation of final concrete volume for each shaft is to be made. Core and check the integrity of shafts taking an unreasonably high or low volume of concrete.

F. If caving soil conditions or excessive groundwater is encountered, use of temporary casing is permitted to prevent caving of material around shaft and to control seepage of groundwater into excavation.

G. Casing material is to be metal of ample strength to withstand handling stresses, pressure of concrete and of surrounding earth or backfill materials and is to be water-tight. Casing shall be smooth, clean and free of accumulations of hardened concrete. Outside diameter of casing is not to be less than specified diameter of drilled shaft.

H. Elapsed time is not to exceed one hour from beginning of concrete placement in cased portion of shaft, until extraction of casing is begun.

I. Withdraw temporary casings as shaft is filled with concrete, or immediately following concreting operation. Bottom of casing is to always remain at least 1-Ft. below level of concrete during placement to overcome hydrostatic pressure. Smoothly extract casing with vibratory hammer. Casing extraction

is to be at slow, uniform rate with pull in line with vertical axis of shaft. Leave no casing in place.

J. If upward movement of concrete or reinforcing steel occurs inside casing at beginning of pulling operation or at anytime during pulling, stop pulling immediately and leave casing in place.

K. If casing must be left in place, Public Works is to be informed to determine shaft capacity calculations.

3.04 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

3.05 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01504 – Temporary Facilities and Control or Section 01576 - Waste Material Disposal.

END OF SECTION

SECTION 02476

CAISSON FOR LIFT STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Constructing external walls of lift station wet well structures by caisson method, including base slab and excavation cell partitions. Valve/pump chamber to be constructed by open cut.

B. If method of construction is not specified, Contractor may select caisson method as an alternate to open-cut method for wet well construction.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for lift station construction using caisson method. Include cost for caisson construction in lump sum for lift station.

2. No separate measurement will be made for payment of concrete in wet well caisson except listed in an approved schedule of values.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITION

A. Caisson is defined as external walls of concrete structure, together with excavation cell partition walls, erected at-grade or in starter pit and sunk by gravity to final position through excavation inside structure under dry or wet conditions. Complete caisson includes structural base slab. Caisson walls provide ground support during construction and for permanent installation.

B. Dry construction means that Contractor operates sufficient external ground water control system to maintain ground water level and piezometric head safely below excavation bottom within caisson.

C. Wet construction means that external hydrostatic ground water pressure is

counteracted by water or slurry within caisson.

1.04 REFERENCE STANDARDS

A. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3 (600 kN-m/m3).

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit drawings and design calculations prepared by Contractor's Engineer.

1. Show modifications proposed to lift station structure design required for caisson construction.

2. Submit wall design including water jet, bentonite and grout pipes, and injection ports, and dimensions of annular space for bentonite lubrication. Show increased wall thickness for dead weight when required to sink caisson.

3. Show height of each concrete placement lift and construction joint locations.

C. Submit safety plan to meet OSHA requirements. These procedures will not be subject to approval by Public Works and are for record purposes only. Address in plan, as minimum but not limited to the following:

1. Protection against caisson instability, soil instability, and ground water inflow.

2. Safety for caisson access and exit, including ladders, stairs, walkways, and hoists.

3. Protection against equipment operations, and for lifting and hoisting equipment and material.

4. Support of surcharge weights.

5. Ventilation systems.

6. Monitoring for hazardous gases.

7. Protection against flooding of caisson and inflow into sewers when connected to caisson structure.

8. Protection of workers and public, including traffic barriers, accidental or unauthorized entry, and falling objects.

9. Safety supervising responsibilities.

D. Building and Structures Assessment. Submit for review prior to construction, Building and Structures Assessment Plan. Provide preconstruction and post-construction assessment reports for buildings and structures located within distance equal to depth of caisson but at least 50-Ft. in plan from proposed caisson perimeter. Include photographs or video of existing damage to structures in vicinity of caisson in assessment reports.

E. Caisson Survey. Submit Caisson Survey identifying required modifications to complete lift station and to comply with specified tolerances.

PART 2 PRODUCTS

2.01 CONCRETE

A. Concrete is to be in accordance with Section 03310 - Structural Concrete.

2.02 REINFORCEMENT

A. Reinforcement is to be in accordance with Section 03211 - Concrete Reinforcement.

2.03 EMBEDDED ITEMS

A. Embedded items are to be in accordance with Section 15140 - Pipe Hangers, Supports, and Restraints.

2.04 BACKFILL

A. Select material is to be in accordance with Section 02316 - Excavation and Backfill for Structures.

B. Cement stabilized sand is to be in accordance with Section 02321 - Cement Stabilized Sand.

2.05 GROUT

A. Use grout conforming to Section 02431 - Tunnel Grout.

PART 3 EXECUTION

3.01 SITE PREPARATION

A. Perform site preparation for site clearing and for grading of site to required elevation. Provide for site drainage.

B. Relocate and protect utilities to remain that may be affected by caisson construction area, including starter pit.

C. Install security fencing around caisson construction areas to prevent accidental or unauthorized entry.

D. Provide for control of ground water and surface water according to Section 01578 - Control of Ground Water and Surface Water.

E. Compact disturbed soils to 95 percent of maximum density as determined by ASTM D 698. Compact soil at moisture content sufficient to develop required density.

3.02 CAISSON WALL CONSTRUCTION

A. Place concrete as specified in Section 03310 - Structural Concrete.

B. Inspect concrete surfaces after form removal and repair defects before wall section is sunk into ground.

3.03 CAISSON CLEAN UP AND INSPECTION

A. Clean interior of caisson after seal slab has been poured. Remove soil, mud, slurries, spilled grout or concrete, or other materials not part of structure from caisson and clean surfaces.

B. Inspect caisson for possible structural damage or damage to embedded items occurring during excavation and caisson sinking. Notify and allow Public Works to witness caisson inspection. Repair and replace damage before proceeding with construction.

3.04 CAISSON CONSTRUCTION TOLERANCES

A. Maximum acceptable deviation of caisson from vertical is 1-In. in 5-Ft..

B. Maximum acceptable horizontal deviation from design location of center of caisson at ground surface level is 12-In..

C. Install elevation of base of caisson structure equal to or lower than elevation shown in Drawings. Show top of caisson structure elevation on Drawings.

D. Provide block-outs with allowance for pipe entry deviations of plus or minus 1.5-In. vertically and plus or minus 6-In. horizontally, plus caisson construction tolerances.

E. Tolerances defined above are only acceptable provided that Contractor can adjust sewer connections, structural, mechanical and electrical components to resolve deviation from plumpness and horizontal or vertical location as approved by Public Works. Adjustments must be made without adversely affecting operation or maintenance of lift station.

F. Monitor caisson installation to verify that no settlement or heave is observed for 10 consecutive days starting not later than 50 days after structural completion.

3.05 BACKFILL

A. Remove starter pit shoring to depth of at least 8-Ft. below ground surface and for at least 5-Ft. from pipes and tunnels penetrating shoring. Remove shoring concurrent with backfilling operations. Perform shoring removal and backfilling so that stability of pit is maintained.

B. Compact backfill material in accordance with Sections 02316 - Excavation and Backfill for Structures.

3.06 MONITORING

A. Settlement. Install series of settlement monitoring points on ground and structures within area of potential influence due to soil movements at caisson, before start of caisson or starter pit construction.

1. As minimum, equally space 4 monitoring points around caisson at distance of 15-Ft. and 4 more at distance 30-Ft. from caisson for total of 8 monitoring points.

2. Survey monitoring point elevations before start of caisson excavation and weekly thereafter until structure has been completed and dewatering terminated.

B. Caisson

1. Determine plumpness of caisson at least once each shift at two locations, 90 degrees apart, during caisson sinking operations until caisson is secured by grout and base slab hardened, .

2. As soon as caisson has been secured, install 3 benchmarks, 120

degrees apart, on top concrete placement for settlement monitoring of installed caisson. Transfer benchmarks to higher elevation on structure as required due to continued lift station construction. Continue weekly monitoring of settlement points until 60 days after completed construction of structure.

3. Install and monitor borehole heave points in caisson for dry construction as defined on Drawings. Survey heave points before excavation starts and upon retrieval when final excavation bottom has been reached.

C. Submit monitoring results to Public Works weekly.

3.07 CAISSON SURVEY

A. When caisson has been secured, seal slab poured, and, in case of wet construction, when fluid has been pumped out, survey installed caisson for compliance with tolerances defined in Paragraph 3.04, Caisson Construction Tolerances. Include in Survey:

1. Location of center of caisson at ground level

2. Elevation of top and bottom of caisson and structural slab connection

3. Elevation and locations of penetrations and embedded items and other support points for lift station installation completion

4. Deviation from plumb from caisson top to structural slab at two locations 90 degrees apart

3.08 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 03310 - Structural Concrete and Section 01450 - Contractor's Quality Control.

3.09 DISPOSAL OF EXCESS MATERIAL

A. Remove excavated material from job site in accordance with Section 01576 - Waste Material Disposal.

END OF SECTION

SECTION 02501

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ductile iron pipe and fittings for water lines, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for ductile iron pipe and fittings under this Section, with the exception of extra fittings in place. Include cost in unit prices for work as specified in the following Sections, as applicable:

   a. Section 02511 - Water lines

   b. Section 02531 - Gravity Sanitary Sewers

   c. Section 02532 - Sanitary Sewage Force Mains

   d. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Extra Ductile Iron Compact Fittings in Place shall be for additional fittings required to complete job. This is not to exclude extension of pipe across driveway or intersection for purpose of terminating line in more advantageous position. This determination shall be at discretion of Public Works. This bid item includes additional fittings as may be necessary to complete job in conformance with intent of Drawings.

C. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.4 (AWWA C 104) - Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, for Water.

C. ANSI A 21.11 (AWWA C 111) - Standard for Rubber Gasket Joints for

Ductile-Iron Pressure Pipe and Fittings.

D. ANSI A 21.15 (AWWA C 115) - Standard for Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.

E. ANSI A 21.51 (AWWA C 151) - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.

F. ANSI A 21.53 (AWWA C 153) - Standard for Ductile Iron Compact Fittings, 3-In. through 24-In. and 54-In. through 64-In. for Water Service.

G. ANSI A 21.5 (AWWA C 105) – Polyethylene Encasement for Ductile Iron Pipe Systems.

H. AWWA C 600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

I. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe

J. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

K. American Association of State Highway Transportation Officials (AASHTO).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's certifications that ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51 (AWWA C 151).

C. Submit certifications that pipe joints have been tested and meet requirements of ANSI A 21.11.

D. Submit affidavit of compliance in accordance with ANSI A21.16 for fittings with fusion bonded epoxy coatings or linings.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile Iron Pipe to conform to the following pressure classes for AWWA C 151, push-on or mechanical joint, based on Type 3 bedding conditions, a depth of bury of 6 feet, and a working pressure of 150 psi.

3" through 12"	350 psi
16" and 20"	250 psi
24"	200 psi
30" through 64"	150 psi

B. Provide pipe sections in standard lengths, not less than 18-Ft. long, except for special fittings and closure sections as indicated on shop drawings.

C. Provide flange adapter with insulating kit as required when connecting new piping to piping of different materials, unless otherwise approved by Public Works.

D. Each length of pipe furnished shall bear identification markings in conformance with Sec. 51.10 of AWWA Standard C151.

2.02 JOINTS

A. Joint Types: Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. All rubber joint gaskets utilized on ductile-iron pipe shall be conformance with ANSI/AWWA C111/A21.11 Standard, latest revision. For bolted joints, conform to requirements of AWWA C111.

B. Where required by Drawings, provide approved restrained joints for buried service.

C. Threaded or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 02515 - Hydrostatic Testing of Pipelines or Section 02532 - Sanitary Sewer Force Mains, as applicable. Provide restrained joints for test pressure or maximum surge pressure as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.

E. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer for pipe joints or restraint joints. Submit details of other methods of providing curves and bends for consideration by Public Works. When other methods are deemed satisfactory, install at no additional cost to the City.

2.03 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for

pipe they connect to. Use mechanical joint fittings unless otherwise shown in plans.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11; minimum pressure rated at 250 psi.

E. Ductile Iron Compact Fittings for Water lines: ANSI A 21.53; 4-In. through 12-In. diameter fusion bonded epoxy-lined or cement mortar lining.

2.04 COATINGS AND LININGS

A Water lines

1. Interiors: All pipes shall have an interior cement mortar lining applied in accordance with ANSI/AWWA C104/A21.4, latest revision. No asphaltic coating will be required on the interior cement mortar lining; comply with NSF 61.

2. Exterior coating shall consist of a nominal one-mil thick asphaltic material applied to the outside of the pipe as described in Section 51.8 of AWWA C151.

B. Sanitary Sewer and Force Main:

1. Preparation: Commercial blast cleaning conforming to SSPC-SP6.

2. Liner thickness: Nominal 40-Mils., for pipe barrel interior; minimum 6 to 10-Mils. at gasket groove and outside spigot end to 6-inches back from end.

3. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.

4. Accepted Interior Lining Materials:

a. Provide approved virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage; heat bonded to interior surface of pipe and fittings.

b. Ceramic Epoxy – Protecto 401

c. SewperCoat – double thickness of standard identified ion AWWS C104. A seal coat shall be applied to the lining as

identified on AWWA C104.

5. Exterior: Prime coat and outside asphaltic coating conforming to ANSI A21.10, ANSI A21.15, or ANSI A21.51 for pipe and fittings in open cut excavation and in casings.

C. Sanitary Sewer Point Repair Pipe: For pipes which will be lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A 21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.05B, Sanitary Sewer and Force Main Interiors.

D. Polyethylene Wrap: For buried pipes not cathodically protected, double wrap with polyethylene wrap unless otherwise specified or shown. Conform to requirements of Section 02528 - Polyethylene Wrap.

F. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

G. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer for maximum resistance to the contaminants identified in the Phase II Environmental Site Assessment Report.

H. For water lines cathodically protected, supply ductile iron pipe with either tape coatings or some other bonded dielectric coating as specified in Section 02518 - Steel Pipe and Fittings for Large Diameter Water Lines.

2.05 MANUFACTURERS

A. Use pre-approved manufacturers listed in the City of Schertz approved products.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to installation requirements of Sections 02511 - Water Lines, 02531 - Gravity Sanitary Sewers, 02532 - Sanitary Sewer Force Mains 02561 - Storm Sewers and 02553 - Point Repairs and Obstruction Removal, except as modified in this Section.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install all ductile iron pipe in double polyethylene wrap, unless cathodic

protection is provided. Do not use polyethylene wrap with a cathodic protection system.

D. Holiday Testing.

1. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.

2. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

3.02 FIELD REPAIR OF COATINGS

A. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.

B. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

END OF SECTION

SECTION 02502

STEEL PIPE AND FITTINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel pipe and fittings for water lines for aerial crossings, above ground pipe, and encasement sleeves. Do not bury steel pipe, unless it is large diameter water line.

B. Specifications identify requirements for small-diameter less than or equal to 20-In..

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for steel pipe and fittings under this Section. Refer to Section 02511 - Water Lines for measurement and payment.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO - Standard Specifications for Highway Bridges.

B. ASME B 16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.

C. ASTM A 36 - Standard Specification for Carbon Structural Steel.

D. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

E. ASTM A 105 - Standard Specification for Carbon Steel Pipe Forgings for Piping Applications

F. ASTM A 106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

G. ASTM A 135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.

H. ASTM A 139 - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).

I. ASTM A 1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

J. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

K. AWWA C 200 - Standard for Steel Water Pipe 6 in. and Larger.

L. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

M. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4-In. through 144-In.

N. AWWA C 210 - Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

O. AWWA M 11 – Steel Pipe – A Guide for Design and Installation.

P. SSPC Good Painting Practice, Volume 1.

Q. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.

R. SSPC SP 5 - Joint Surface Preparation Standard White Blast Cleaning.

S. SSPC SP 6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.

T. SSPC SP 10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.

U. SSPC VIS 1 - Visual Standard for Abrasive Blast Cleaned Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures. For aerial crossings and above ground piping, include lay schedule of new pipe and fittings indicating alignment and grade, laying dimensions, lining and coating systems, proposed welding procedures, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings.

B. Submit manufacturer's certifications that pipe and fittings are new and unused.

C. Submit manufacturer's certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C 200.

D. Submit manufacturer's affidavits that coatings and linings comply with applicable requirements of this Section and:

1. Polyurethane coatings were applied in strict accordance with manufacturer's recommendation and allowed to cure at temperature 5 degrees above dew point.

2. Linings were applied and allowed to cure at temperature above 32 degrees F.

E. Submit certification from NACE Certified Coatings Inspector, having Level III certification for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected were properly repaired.

1.05 QUALITY CONTROL

A. Prior to start of work, provide proof of certification of qualification for welders employed for type of work, procedures and positions involved. Provide welder qualifications in accordance with AWWA C 206.

B. Shop-applied coatings and linings; provide services of an independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Perform inspection by NACE trained inspectors under supervision of NACE Level III Certified Coatings Inspector verifying compliance with same requirements specified in Paragraph 3.02.

C. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.

D. Final Inspection:

1. Before shipment, inspect each finished pipe, fitting, special and accessory for markings, metal thickness, coating thickness, lining thickness (if shop applied), joint dimensions, and roundness.

2. Inspect for coating placement and defects. Test exterior coating for holidays.

a. Inspect linings for thickness, pitting, scarring, and adhesion.

E. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.

PART 2 PRODUCTS

2.01 STEEL PIPE

A. Manufacture pipe with nominal diameter 20-In. and less but more than 2-In. to conform to ASTM A106 or A 53 Grade B, standard weight.

B. Provide steel pipe and encasement sleeves designed and manufactured in conformance with AWWA C 200 and AWWA M 11 except as modified herein. Steel to be minimum of ASTM A 36, ASTM A 1011 Grade 36, ASTM A 53 Grade B, ASTM A 135 Grade B, or ASTM A 139 Grade B.

Table 1 Minimum Allowable Steel Wall Thickness - Carrier Pipe

NOM. PIPE SIZE (In.)	Min. Wall O.D. (In.)	Min. Wall Thick (In.)	Approx. Wt. Per L.F.Uncoated (Lb.)
4	4.50	0.250	11.35
6	6.625	0.280	18.97
8	8.625	0.322	28.55
10	10.75	0.365	40.48
12	12.75	0.375	49.56
16	16.00	0.375	62.58
20	16.00	0.375	78.60

Notes Carrier Pipe:

1. Review pipe and fitting design for conditions exceeding those specified herein.
2. Provide pipe with wall thickness of no less than listed in table above.

Table 2 Minimum Diameter Casing Pipe -(Encasement Sleeves)

Casing Pipe Size (In.)	Min. Wall O.D. (In.)	Min. Wall Thick (In.)	Approx. Wt. Per L.F. Uncoated (Lb.)
12	12.75	0.219	29.28
16	16.00	0.219	36.86
18	18.00	0.250	47.39
20	20.00	0.250	52.73
24	24.00	0.250	63.41

Notes for Casing Pipe:

1. Provide casing pipe with wall thickness of no less than listed in table above.
2. Casing pipe: AWWA C 200 new uncoated welded steel.
3. Verify casing diameter required with dimensions of casing spacer.

D. Provide pipe sections in lengths of no less than 16-Ft. except as required for special sections, and no greater than 40-Ft.

E. Provide short sections of steel pipe no less than 4-Ft. in length unless indicated on Drawings or specifically permitted by Public Works.

F. Fittings: Factory forged for sizes 4-In. through 20-In.; long radius bends; beveled ends for field butt welding; wall thickness equal to or greater than pipe to which fitting is to be welded unless otherwise shown on Drawings.

G. Joints:

1. Standard field joint for steel pipe and encasement sleeve: AWWA C 206. Single - welded, butt joint.

2. Provide mechanically coupled or flanged joints for valves and fittings, as shown on Drawings. Flanges: AWWA C 207, Class D; same diameter and drilling as Class 125 cast iron flanges ASME B 16.1. Maintain electrically isolated flanged joints between steel and cast iron by using epoxy-coated bolts, nuts, washers and insulating type gasket.

3. Elbows to be standard weight seamless elbows per ASTM A106, Grade A or B.

4. Flanges for pipe 20-In. in diameter and smaller shall be ANSI 150 lb. flat face, slip on or weld neck flanges, meeting ASTM A105 requirements. Where flanges are to join to valves with raised face flanges, use ANSI 150 lb. raised flange.

5. Provide same coating for exposed portions of nuts and bolts as flanges which they secure.

H. Fabricate flanges with over-size bolt holes, with flanges drilled in pairs, to accommodate insulating sleeves.

2.02 INTERNAL LINING SYSTEMS FOR STEEL PIPE, ALL INSTALLATIONS

A. Supply steel pipe with epoxy lining, capable of conveying water at temperatures not greater than 140 degrees F. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61 and certification to be from organization accredited by ANSI. Unless otherwise noted, coat exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, etc., with epoxy lining, as specified.

B. Epoxy Lining AWWA C 210, White, or approved equal for shop and field joint applied, except as modified in this Section. Provide material from same manufacturer. For Pipe larger than 2-In. in diameter protect interior surface with liquid two-part chemically cured epoxy primer specified for interior surfaces.

Surface Preparation 2.0 to 3.0 mils surface profile	SSPC – 5 (64) White Blast Clean
Prime Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy – Buff, or approved equal
Intermediate Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy – Buff, or approved equal
Finish Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy – White, or approved equal

1. Total allowable dry film thickness for system:

   a. Minimum: 12.0 mils.

   b. Maximum: 18.0 mils.

   c. Minimum field adhesion: 700 psi.

2. Dry film thicknesses for approved alternate products in accordance with product manufacturer's recommendations.

3. Lining system may consist of three or more coats of same approved alternate epoxy lining without use of separate primer.

2.03 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVEGROUND AND IN VAULTS (EXPOSED)

A. Provide external coating system as designated in Section 09905 Cleaning And Painting Exposed Piping, Valves And Related Items.

B. Clean bare pipe free from mud, mill lacquer, oil, grease, or other contaminant. Inspect and clean surfaces according to SSPC-SP-1 to remove oil, grease, and loosely adhering deposits prior to blast cleaning. Remove visible oil and grease spots by solvent wiping. Use only approved safety solvents which do not leave residue. Use preheating to remove oil, grease, mill scale, water, and ice provided pipe is preheated in uniform manner to avoid distortion.

C. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges, presence of metallic defects may be cause for rejection of pipe.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Conform to applicable provisions of Section 02511 - Water lines, except as modified in this Section.

B. Comply with the following:

1. Bedding and Backfilling: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

2. For pipes with coating: Do not roll or drag pipe on ground, move pipe in such a manner as not to damage pipe or coating. Carefully inspect pipe for abrasions and repair damaged coating before pipe is installed.

C. Static Electricity:

1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.

2. Electrically test where required after installation is complete.

3.02 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVE GROUND AND IN VAULTS (EXPOSED) AND EPOXY INTERNAL LINING SYSTEM.

A. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.

B. Workmanship:

1. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.

2. Paint Application Procedures: SSPC Good Painting Practices, Volume 1.

C. Surface Preparation:

1. Prepare surfaces for painting by using abrasive blasting.

2. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly-painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.

3. Prior to blasting, clean surfaces to be coated or lined of grease, oil and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.

4. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux and spatter by

grinding to ¼-In. minimum radius.

5. Abrasive Material:

   a. Blast only as much steel as can be coated same day of blasting.

   b. Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to job site in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.

   c. After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Tex Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to Public Works.

   d. Do not blast if metal surface may become wet before priming commences, or when metal surface is less than 5 degrees F above dew point.

6. Evaluate degree of cleanliness for surface preparation with use of SSPC Pictorial Surface Preparation Standards for Painting Steel Surfaces, SSPC-Vis

7. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing ¾-In. by 4-In. piece of clear Scotch type tape on blasted surface, then removing and placing tape on 3x5 white index card. Reclean areas exhibiting dust or residue.

D. Coating and Lining Application:

1. Environmental Conditions: Do not apply coatings or linings when metal temperature is less than 50 degrees F; when ambient temperature is less than 5 degrees F above dew point; when expected weather conditions are such that ambient temperature will drop below 40 degrees F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper humidity levels.

2. Application Procedures:

   a. Apply in accordance with manufacturer's recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive over spray, or delaminations.

b. Thin materials only with manufacturers recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.

c. Discard catalyzed materials remaining at end of day.

3. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.

4. Cure a minimum of 24 hours at 77 degrees F before successive coats are applied. During curing process, provide force air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coatings are applied, provide forced air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.

E. Testing of Coatings and Linings:

1. Inspect pipe for holidays and damage to coating:

a. If test indicates no holidays and coating is damaged, remove damaged layers of coating and repair in accordance with coating manufacturer’s recommendations.

2. Perform holiday test in accordance with NACE Standard Recommended Practice, RPO 188-90, Discontinuity (Holiday) Testing of Protective Coatings.

3. Begin testing of completed coating after coating has sufficiently cured, usually one to 5 days. Consult coating manufacturer for specific curing schedule.

4. Perform adhesion test on pipe in accordance with ASTM D 4541.

5. For coating thickness of 20-Mils. or less, test with wet sponge low-voltage holiday detector. For coating thickness in excess of 20-Mils., test with high-voltage holiday detector. Perform electrical holiday test with 60-cycle current audio detector. Select test voltage as suggested in table below.

Table 3 Minimum Voltages For High Voltage Spark Testing

Total Dry Film Thickness (Mils.)	Suggested Inspection (V)
20 to 40	3,000
41 to 55	4,000
56 to 80	6,000

3.03 JOINTS AND JOINTING

A. Welded Joints:

1. Conform to requirements of Section 02511 - Water Lines.

2. Field weld to be full penetration butt welded joints for steel pipe and encasement sleeves for entire circumference.

3. City will employ an independent certified testing laboratory to perform weld acceptance tests on welded joints. Testing Laboratory will test by X-ray methods for butt welds, for 100 percent of joint welds. Public Works has final decision as to suitability of welds tested.

B. Flanged Joints: Conform to requirements of Section 02511 - Water Lines.

C. Joint Grouting and Testing: Conform to requirements of Section 02511 - Water Lines.

3.04 COATINGS AND LININGS INSPECTION RESPONSIBILITIES

A. Contractor is responsible for quality control of coatings and linings applications and testing and inspection stipulated in this Section. Public Works is responsible for quality assurance and reserves the right to inspect or acquire services of an independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high-performance coatings at all phases of coatings and linings work, field- or shop-applied. Contractor is responsible for proper application and performance of coatings and linings whether or not Public Works provides such inspection.

END OF SECTION

SECTION 02503

COPPER TUBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Copper tubing for water service lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for copper tubing under this Section. Include cost in unit price for water taps and service lines.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM B 88 - Standard Specification for Seamless Copper Water Tube.

B. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certified test results of ASTM B 88.

C. Submit manufacturer's testing certification that copper tubing conforms to requirements of ASTM B 88. Number of samples for testing of each size of tubing is modified as follows:

1. For each 7500-Ft. of tubing: 1 sample

2. For each set of tubing less than 7500-Ft.: 1 sample

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide Type K annealed, seamless, copper tubing, 3/8-In. to 2-In. in diameter conforming to requirements of ASTM B 88.

B. Provide 3/8-In. and 1-In. tubing in coils of minimum 60-Ft. in length, and 11/2-

In. and 2-In. tubing in coils 40-Ft. in length.

C. Provide tubing manufactured in United States of America. Tubing shall be inspected and tested by laboratory designated by Public Works at point of manufacture or locally. Furnish tubing, at no additional cost to designated testing laboratory along with mill compliance certificates.

D. Provide flared or compression-type brass fittings for use with Type K annealed copper tubing in accordance with AWWA C 800.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to installation requirements of Section 02512 - Water Tap and Service Line Installation, except as modified in this Section.

3.02 JOINTS

A. Minimum joint spacing for 3/4-In. and 1-In. tubing shall be 60-Ft. and for 1 1/2-In. and 2-In. tubing shall be 40-Ft..

B. Cut copper tubing squarely by using cutting tools designed specifically for purpose and avoid procedures that cause pipe to bend or pipe walls to flatten.

C. After tubing has been cut, but before flaring, use reamer to remove inside rolled lip from tubing. Expand flared ends by use of flaring tool using care to avoid splitting, crimping, or over stressing metal. Provide at least 10-In. of straight pipe adjacent to fittings.

D. When compression fittings are used, cut copper tubing squarely prior to insertion into fitting. Assemble in accordance with manufacturer's recommended procedure.

3.03 BENDS

A. Bend tubing by using appropriate sized bending tool. No kinks, dents, flats, or crimps shall be permitted. Cut out and replace damaged section. Install no bends with radius smaller than radius of coil of tubing as packaged by manufacturer. Copper tubing shipped in straight lengths conforms to the following:

1. For 2-In. diameter: Maximum of one 45-degree bend per 4-Ft. section.

2. For 1 1/2-In. diameter: Maximum of one 45-degree bend per 3-Ft. section.

END OF SECTION

SECTION 02505

HIGH DENSITY POLYETHYLENE (HDPE) SOLID AND PROFILE WALL PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High density polyethylene (HDPE) pipe for gravity sewers and drains, including fittings.

B. High density polyethylene (HDPE) pipe for sanitary sewer force mains, including fittings.

C. High density polyethylene (HDPE) pipe for storm sewers culverts.

D. High density polyethylene (HDPE) pipe for water service lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for HDPE pipe under this Section. Include cost in unit prices for work, as specified in following sections:

a. Section 02531 - Gravity Sanitary Sewers.

b. Section 02532 - Sanitary Sewer Force Mains.

c. Section 02631 - Storm Sewers.

d. Section 02512 – Water Tap and Service Line Installation.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Drainage Pipe, 18-In. – 48-In. diameter.

B. AASHTO Section 18 - Soil Thermoplastic Pipe Interaction Systems.

C. AASHTO Section 30 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

D. ASTM D 618 - Standard Practice for Conditioning Plastics for Testing.

E. ASTM D 1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

F. ASTM D 2321 - Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Pipe.

G. ASTM D 2657 - Standard Practice for Heat Fusion Joining Polyolefin Pipe and Fittings.

H. ASTM D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

I. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

L. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

M. ASTM F 714 - Standard Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

N. ASTM F 894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.

O. AWWA C800 – Standard for Underground Service Line Valves and Fittings.

1.04 1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings showing design of pipe and fittings, laying dimensions, fabrication, fittings, flanges, and special details.

1.05 QUALITY CONTROL

A. Provide manufacturer's certificate of conformance to Specifications.

B. Furnish pipe and fittings that are homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Provide pipe as uniform as commercially practical in color, opacity, density, and other physical properties.

C. Public Works reserves right to inspect pipes or witness pipe manufacturing. Inspection shall in no way relieve manufacturer of responsibilities to provide products that comply with applicable standards and these Specifications.

1. Manufacturer's Notification: should Public Works wish to witness manufacture of specific pipes, manufacturer shall provide Public Works with minimum three weeks notice of when and where production of those specific pipes will take place.

2. Failure to Inspect. Approval of products or tests is not implied by Public Works decision not to inspect manufacturing, testing, or finished pipes.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with documented experience of minimum 5 years of pipe installations that have been in successful, continuous service for same type of service as proposed work.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide products manufactured by companies listed on the Public Works list of approve products. Each standard and non-standard length of pipe or fitting shall be clearly marked with pipe size, pipe class, production code, material designation and other relevant identifying information.

B. HDPE pipe is not approved in applications requiring augering of sewer pipe.

C. Furnish solid wall pipe with plain end construction for heat joining (butt fusion) conforming to ASTM D 2657. Utilize controlled temperatures and pressures for joining to produce fused leak-free joint.

D. Furnish solid wall pipe for sanitary sewer force mains with minimum working pressure rating of 150 psi, and with inside diameter equal to or greater than nominal pipe size indicated on Drawings.

E. Furnish profile-wall gravity sewer pipe with bell-and-spigot end construction

conforming to ASTM D 3212. Joining will be accomplished with elastomeric gasket in accordance with manufacturer's recommendations. Use integral bell-and-spigot gasketed joint designed so that when assembled, elastomeric gasket, contained in machined groove on pipe spigot, is compressed radially in pipe bell to form positive seal. Design joint to avoid displacement of gasket when installed in accordance with manufacturer's recommendations.

F. Furnish solid wall pipe for water service lines with minimum working pressure rating of 200 psi, and with an inside diameter equal to or greater than nominal pipe size indicated on Drawings.

G. Furnish corrugated polyethylene pipe (CPP) for gravity storm sewer pipe. Joints shall be installed such that connection of pipe sections will form continuous line free from irregularities in flow line. Suitable joints are:

1. Integral Bell and Spigot. Bell shall overlap minimum of two corrugations of spigot end when fully engaged.

2. Exterior Bell and Spigot. Bell shall be fully welded to exterior of pipe and overlap spigot end so that flow lines and ends match when fully engaged.

H. Jointing:

1. Gaskets:

a. Meet requirements of ASTM F 477. Use gasket molded into circular form or extruded to proper section and then spliced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.

b. Pipes allowed to be installed in potentially contaminated areas, where free product is found near elevation of proposed sewer, shall have the following gasket materials for noted contaminants:

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by pipe manufacturer

2. Lubricant: Use lubricant for assembly of gasketed joints which has no detrimental effect on gasket or on pipe, in accordance with manufacturer’s recommendations.

2.02 MATERIALS FOR SANITARY SEWER

A. Pipe and Fittings: High density, high molecular weight polyethylene pipe material meeting requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248. Material meeting requirements of cell classification in accordance with ASTM D 3350 are also suitable for making pipe products under these specifications. Pipe will have light colored interior.

1. Solid wall HDPE pipe referred to as Drisco 1000, Drisco 8600, Quail Pipe, Poly Pipe, and Plexco Pipe that is in conformance with ASTM F714 and ASTM requirements stated herein are considered approved for this project. HDPE pipe will further be required to have a minimum pipe stiffness of 46 psi for 12” to 48” diameter pipe and 115 psi for 8” to 10” diameters as required by TCEQ. (see table below)

Table 1 HDRP pipe SDR rating per Depth

Existing Nominal Diameter (Inches)	Minimum Outside Diameter (Inches)	Minimum Wall Thickness (Inches)		
		15'Deep	15'>Depth ≤20'	>20Deep
		SDR 19	SDR 17	SDR 11
6-8	8.625	0.454	0.507	0.784
10	12.75	0.671	0.750	1.159
12	14.0	0.737	0.824	1.273
15	16.0	0.842	0.941	1.455
18	20.0	1.053	1.176	1.818

B. Other Pipe Materials: Materials other than those specified in Paragraph 2.02A, Pipe and Fittings, may be used as part of profile construction, e.g., as core tube to support shape of profile during processing, provided that these materials are compatible with base polyethylene material and are completely encapsulated in finished product and in no way compromise performance of pipe products in intended use. Examples of suitable material include polyethylene and polypropylene.

2.03 MATERIALS GRAVITY STORM SEWERS AND STORM SEWER CULVERTS

A. Pipe and Fittings: High density, high molecular weight polyethylene HDPE virgin compound material meeting requirements of cell class outlined in ASTM D 3350. Manufacturing shall meet requirements of ASTM F2306.

2.04 TEST METHODS FOR SANITARY SEWER

A. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Public Works. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

B. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.05A, in suitable press until internal diameter has been reduced to 40 percent of original inside diameter of pipe. Rate of loading shall be uniform and at 2-In. per minute. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles.

C. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except replace shear load transfer bars and supports with 6-In. wide support blocks that can be either flat or contoured to conform to pipe's outer contour.

D. Purpose of Tests. Flattening and joint tightness tests are not intended to be routine quality control tests, but rather to qualify pipe to a specified level of performance.

2.05 TEST METHODS FOR RESDENTIAL DRIVEWAY CULVERTS

A. Pipe stiffness at 5 percent deflection, when determined in accordance with ASTM D 2412, shall be as specified in Section 7.4 of AASHTO M 294.

B. Minimum inner wall thickness shall be as specified in Section 7.2.2 of AASHTO M 294.

2.06 MARKING

A. Mark each standard and random length of pipe in compliance with these Specifications with following information:

1. Pipe size.

2. Pipe class.

3. Production code.

4. Material designation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to requirements of following Sections:

1. Section 02550 - Sliplining Sanitary Sewers.

2. Section 02531 - Gravity Sanitary Sewers.

3. Section 02532 - Sanitary Sewage Force Mains.

4. Section 02533 - Acceptance Testing for Sanitary Sewers.

5. Section 02631 - Storm Sewers

B. Install pipe in accordance with the manufacturers recommended installation procedures.

C. Bedding and backfill: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

D. Do not store pipe uncovered direct in direct sunlight. Allow pipe temperature to approach ground temperature before each individual pipe section is terminally connected.

3.02 JOINTS

A. Join sections of Solid Wall HDPE pipe into continuous lengths above ground by thermal butt fusion method in accordance with AWWA C906 and pipe manufacturer's recommendations for specified service. Fusion joints: meeting minimum requirements of manufacturer for cool down time and other fusing requirements. Socket fusion and extrusion welding or hot gas welding will not be accepted.

B. The butt-fused joint will be true alignment and will have uniform roll back beads resulting from the use of proper temperature and pressure. The joint surfaces will be smooth. The fused joint will be watertight and will have tensile strength equal to that of the pipe. All joints will be subject to acceptance by the City and/or City representative prior to insertion. All defective joints will be cut out and replaced at no cost to City.

C. Brass fittings for ¾ inch, 1 inch, 1 ½ inch, and 2 inch water service lines shall be of compression type for use with HDPE tubing.

3.03 CUTTING PIPE

A. Comply with pipe manufacturer's recommendations. After cutting, leave end pipe in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 02506

POLYVINYL CHLORIDE PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4-In. through 20-In.

B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4-In. through 48-In.

C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4-In. through 20-In.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for work included as specified in the following sections:

   a. Section 02511 - Water Lines

   b. Section 02531 - Gravity Sanitary Sewers

   c. Section 02532 - Sanitary Sewer Force Mains

   d. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.

B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

C. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

F. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

G. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

H. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

L. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

M. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

N. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.

O. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-In. Through 48-In. for Water.

P. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

Q. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-In. Through 12-In. for Water Distribution.

R. AWWA C 905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14-In. Through 48-In., for Water Transmission and Distribution.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.05 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, and AWWA C 905, and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Public Works for review. Cost of testing paid by Contractor.

PART 2 PRODUCTS

2.01 MATERIAL

A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. PVC Restrained Pipe: Must be listed on the City's current Product Approval List.

1. Pipe Material:

a. DR 14: For restrained joints where shown on Drawings.

b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20-Ft. or less than 4-Ft. Do not use PVC in potentially petroleum contaminated areas.

D. Water Service.

1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to the Texas State Fire Insurance Committee for use in fire protection lines.

2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).

E. Gaskets:

1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.

2. Flat Face Mating Flange: Full faces 1/8-In. thick ethylene propylene (EPR) rubber.

3. Raised Face Mating Flange: Flat ring 1/8-In. ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

G. Do not use PVC in potentially or known contaminated areas.

H. Do not use PVC in areas exposed to direct sunlight.

2.02 WATER SERVICE PIPE

A. Pipe 4-In. through 12-In: AWWA C 900, DR 14; nominal 20-Ft. lengths; cast-iron equivalent outside diameters.

B. Pipe 14-In. through 20-In: AWWA C 905; DR 14; nominal 20-Ft. lengths; cast-iron equivalent outside diameter.

C. Provide Polyvinyl Chloride Pipe from approved manufacturers.

D. No curves and bends by deflecting joints. Submit details of other methods of providing curves and bends for review by Public Works.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

2.03 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table. All sanitary sewer pipe shall be green color:

	Sizes	**Pipe Stiffness (psi)**
Solid Wall	4”-36”	SDR35, PS ≥ 45 psi SDR26, PS ≥ 115 psi
Open Profile Wall	18”-30”	PS ≥ 46 psi
Closed Profile Wall	18”-30”	PS ≥ 46 psi

B. When solid wall PVC pipe 18-In. to 27-In. in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

C. For sewers up to 12-In. diameter crossing over water lines, or crossing under water lines with less than 2-Ft. separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.

E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Public Works. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. For diameters 4-In. through 18-In., test three specimens, each a minimum of 6-In. (152-Mm.) in length. For diameters 21-In. through 36-In., test three specimens, each a minimum of 12-In. (305-Mm.) in length.

H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.

I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.

J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance. Open and Closed Profile Wall pipe must meet Impact Resistance of smooth wall SDR 35.

K. Service connections to sewer pipe of all types shall be watertight with approved manufacturer's compatible connection.

2.04 SANITARY SEWER FORCE MAIN PIPE

A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Section 02532 - Sanitary Sewage Force Mains.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-In. diameter and less.

C. Fittings: Provide approved ductile iron fittings as per Section 02501 - Ductile Iron Pipe and Fittings, Paragraph 2.04, except furnish fittings with one of following approved internal linings:

1. Nominal 40-Mils. (35-Mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting

2. Nominal 40-Mils (35-Mils minimum) polyurethane

3. Nominal 40-Mils (35-Mils minimum) ceramic epoxy

4. Nominal 40-Mils (35-Mils minimum) fusion bonded epoxy

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 02528 - Polyethylene Wrap.

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02E.

2.05 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 250 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12-In. in diameter (water or sanitary).

B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

PART 3 EXECUTION

3.01 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat

or harmful chemicals in accordance with manufacturer's recommendations.

3.02 INSTALLATION

A. Conform to requirements of Section 02511 - Water Lines, Section 02531 - Gravity Sanitary Sewers, and Section 02532 - Sanitary Sewer Force Mains, as applicable.

B. Install PVC pipe in accordance with Section 02317 - Excavation and Backfill for Utilities, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.

C. Install PVC water service pipe to clear utility lines and have minimum depth of cover below property line grade of street, unless otherwise required by Drawings:

1. Water service pipe 12-In. in diameter and smaller 4-Ft. of cover.

2. Water service pipe 16-In. in diameter and larger 5-Ft. of cover.

D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.

E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support.

F. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.

G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

3.03 PVC RESTRAINED MECHANISM

A. Do not apply lubricant to spline or pipe or coupling spline grooves.

B. Do not use excessive force while inserting the spline through coupling.

C. Insert spline until it is fully seated around circumference of pipe.

D. Field Cutting of Pipe Ends:

1. Perform by workers certified by manufacturer.

2. Use a PVC pipe cutter and provide square ends.

3. Use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION

SECTION 02511

WATER LINES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of water lines.

B. Specifications identify requirements for both small diameter (less than or equal to 16-In.) water lines and large-diameter (greater than 16-In.) water lines. When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for water lines installed by open-cut, augered with or without casing, aerial crossing, and pipe offset section or within limits of Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation.

a. Mains: Measure along axis of pipe and include fittings and valves.

b. Branch Pipe: Measure from axis of water line to end of branch.

2. Payment for interconnection is on lump sum basis for each interconnection identified on Drawings. Payment will include tapping sleeve and valves piping, connections and other related work necessary for construction as shown on Drawings or specified herein.

3. Payment for plug and clamp is on a unit price basis for each size of pipe.

4. When directed by Public Works to install extra fittings as required to avoid unforeseen obstacles, payment will be based on the following:

a. Each extra fitting requested by Public Works and delivered to jobsite will be paid according to unit price for "Extra Fittings in Place."

b. Payment will include and be full compensation for items necessary for installation and operation of water line.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile – Iron Pressure Pipe and Fittings.

B. ANSI/NSF Standard 61 - Drinking Water System -Health Components.

C. ASTM A 36 - Standard Specification for Carbon Structural Steel

D. ASTM A 536 - Standard Specification for Ductile Iron Castings

E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes.

G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.

I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.

J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination

K. ASTM E 709 - Standard Guide for Magnetic Particle Examination

L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4-In. through 144-In..

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Conform to submittal requirements of applicable Section for type of pipe used.

C. Photographs: Submit photographs conforming to requirements of Section 01321 - Construction Photographs prior to commencement of construction.

D. Submit videotapes conforming to requirements of Section 01323 – Construction Videotapes, if applicable.

E. Submit Lone Star notification transmittal number prior to beginning excavation.

F. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:

1. Disinfection; not to exceed 4,000-Ft. per section.

2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.

3. Site restoration; not to exceed limits specified; Sequence in order of disturbance.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Install pipe materials which conform to following:

1. Section 02501 - Ductile Iron Pipe and Fittings.

2. Section 02502 - Steel Pipe and Fittings. Water line piping within plant site and aerial crossings to be welded joint steel pipe with flange or approved restraint joint connections, unless otherwise shown on Drawings.

3. Section 02506 - Polyvinyl Chloride Pipe.

4. Section 02518 - Steel Pipe and Fittings for Large Diameter Water Lines.

B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.

C. Type of pipe materials used is identified on drawings.

D. Provide minimum of 3/8-In. inside joint recess between ends of pipe in straight pipe sections.

2.02 WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE

A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.

B. O-rings: Conform to National Sanitary Foundation requirements.

2.03 RESTRAINED JOINTS

A. Ductile-Iron Pipe: See Section 02501 - Ductile Iron Pipe and Fittings.

B. PVC Pipe: See Section 02506 - Polyvinyl Chloride Pipe. Perform hydrostatic testing in accordance with ASTM F 1674.

C. Restrained Joints where required on DIP and PVC pipe:

1. Restraint devices: Manufacture of high strength ductile iron, ASTM A 536 up to 24-In., and ASTM A 36 for sizes greater than 30-In.. Working pressure rating twice that of design test pressure.

2. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.

2.04 COUPLINGS AND APPURTENANCES FOR LARGE DIAMETER WATERLINE

A. Flexible (Dresser-type) Couplings.

1. Install where shown on Drawings or where allowed by Public Works for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from Neoprene or Buna-N.

2. For steel pipe; provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.

3. Provide approved flanged adapter couplings for steel pipe

4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-Mil. of approved coal tar coating.

PART 3 EXECUTION

3.01 PREPARATION

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.

C. Lay pipe to lines and grades shown on Drawings.

D. Confirm that minimum separation from gravity sanitary sewers and manholes or force mains complies with TCEQ requirements

1. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from Public Works before proceeding with construction.

F. Inform Public Works if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by Public Works.

G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing 2 pipe installation crews shall be permitted, unless otherwise approved by Public Works.

H. City of Schertz Utility Operations Division will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.

I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices"

contained in this publication and make them "mandatory practices" for this Project.

J. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.

K. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by Public Works.

3.02 HANDLING, CLEANING AND INSPECTION

A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.

2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.

4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36-In. in width. Do not tear or wrinkle tape layers.

5. Use precautions to prevent injury to pipe, protective linings and coatings.

a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.

b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.

c. Do not lift pipe using hooks at each end of pipe.

d. Do not place debris, tools, clothing, or other materials on pipe.

6. Repair damage to pipe or protective lining and coating before final acceptance.

7. For cement mortar line and coated steel pipe and PCCP, permit no visible cracks longer than 6-In., measured within 15 degrees of line parallel to pipe longitudinal axis of finished pipe, except:

a. In surface laitance of centrifugally cast concrete.

b. In sections of pipe with steel reinforcing collars or wrappers.

c. Within 12-In. of pipe ends.

8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.03 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities and Section 02447 - Augering Pipe and Conduit.

B. Bedding: Use bedding materials in conformance with Section 02320 - Utility Backfill Materials.

C. Backfill: Use soil as specified in Section 02320 - Utility Backfill Materials. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Water tamping is not allowed.

E. Pipe Embedment: Including 6-In. pipe bedding and backfill to 12-In. above top of pipe.

3.04 PIPE CUTTING

A. Cut pipe 12-In. and smaller with standard wheel pipe cutters. Cut pipe larger than 12-In. in manner approved by Public Works. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.05 PIPING INSTALLATION

A. General Requirements:

1. Lay pipe in subgrade free of water.

2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.

3. Properly form bedding to fully support bell without wedging or blocking up bell.

4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than 300-Ft. of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of Public Works prior to skipping any portion of work.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of

each day's work.

D. Perform Critical Location as shown on Drawings. Refer to Section 02317 - Excavation and Backfill for Utilities for additional requirements at critical locations.

E. Laying Large Diameter Water Line

1. Lay not more than 50-Ft. of pipe in trench ahead of backfilling operations.

2. Dig trench proper width as shown. When trench width below top of pipe becomes 4-Ft. wider than specified, install higher class of pipe or improved bedding, as determined by Public Works. No additional payment will be made for higher class of pipe or improved bedding.

3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10-Ft. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100-Ft. on record drawings.

4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.

5. Prior to assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.

6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.

F. Perform following additional procedures when working on plant sites.

1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with Public Works and Water Production personnel. At this meeting, present proposed sequencing of work and verification of readiness to complete work as required and within time permitted. Do not proceed with work until Public Works agrees key personnel, equipment and materials are on hand to complete work.

2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for work.

3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by Public Works and City's Utility Maintenance Division operator is present to observe.

4. Coordinate with City's Water Production Division operators to obtain reduction in operating pressures prior to performing connections to existing piping.

5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Public Works.

6. Perform critical stages of work identified on Drawings at night or during low water demand months as specified in Section 01110 - Summary of Work.

7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.

8. Submit to Public Works Lone Star Notification transmittal number prior to beginning excavation.

9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within 1-Ft. to existing piping by hand methods.

10. Provide adequate notice to pipe manufacture's representative when connecting or modifying existing prestressed or pretension concrete cylinder pipe.

11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Section 01330 -

Submittal Procedures.

12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Public Works by noon on Thursday of week. Contact person must be accessible during weekend, have a Schertz Area phone number, and be authorized to make emergency decisions.

13. No night work or plant shut down will be scheduled to begin two working days before or after designated City Holidays.

G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide the City a minimum of two weeks notice prior to shutting down existing water line.

3.06 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints for PVC, Steel, and DIP:

1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.

2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.

3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.

4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.

5. Where preventing movement of 16-In. diameter or greater pipe is necessary due to thrust, use restrained joints as shown on Drawings.

a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.

b. Do not include passive resistance of soil in thrust restraint calculations.

6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by Public Works.

B. Flanged Joints where required on Ductile Iron Pipe, or Steel Pipe:

1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64-In. per foot inclination of flange face from true alignment.

2. Use full-face gaskets for flanged joints. Provide 1/8-In.thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.

3. Use galvanized or black nuts and bolts to match flange material. Use cadmium- plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Densco petroleum based tape or approved equal for all exposed portions of nuts, bolts and pipe.

4. Full length bolt isolating sleeves and washers shall be used with flanged connections. Furnish kits in accordance with City's "Approved Products List."

5. For in-line flange joints 30-In. in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, conforming to ANSI A 21.11 mechanical joint gaskets. For in-line flange joints sized between 12-In. in diameter and greater and 24-In. in diameter and smaller, provide Phenolic PSI with nitrite seal gasket conforming to ANSI A 21.11 mechanical joint gaskets.

C. Welded Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and

positions involved.

2. Joints: AWWA C 206. Full-fillet, single lap-welded slip-type either inside or outside, or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow or become loose. Do not use mitered joints. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30-In. and smaller.

3. Furnish welded joints with trimmed spigots and interior welds for 36-In. and larger pipe.

4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to ¾-In. as long as 1 ½-In. minimum lap is maintained. Spigot end may be miter cut to take deflections up to 5 degrees as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 5 degrees.

5. Align piping and equipment so that no part is offset more than 1/8-In. Set fittings and joints square and true, and preserve alignment during welding operation. For butt welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16-In. offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.

6. Protect coal-tar-epoxy lining during welding by draping an 18-In.wide strip of heat resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.

7. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.

8. Deposit metal in successive layers to provide at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in completed weld.

9. Deposit no more than ¼-In. of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.

10. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.

11. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.

12. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.

13. Welded Joints for Large Diameter Water Lines:

    a. Furnish pipe with trimmed spigots and interior welds for 36-In. and larger pipe.

    b. Use exterior welds for 30-In. and smaller.

    c. Only one end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2 ½ degrees.

    For large diameter water lines, employ an independent certified testing laboratory, approved by Public Works, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to Public Works for review. Public Works has final decision as to suitability of welds tested.

    Weld acceptance criteria:
    Conduct in accordance with ASTM E165- Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for Magnetic Particle Examination. Use X-ray methods for butt welds, for 100 percent of joint welds.

    Examine welded surfaces for the following defects:
    i) Cracking.

ii) Lack of fusion/penetration.
iii) Slag which exceeds one-third (t) where (t) equals material thickness.
iv) Porosity/Relevant rounded indications greater than 3/16-In.; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width.
v) Relevant linear indications in which length of linear indication exceeds three times its width.
vi) Four or more relevant 1/16-In. rounded indications in line separated by 1/16-In. or less edge to edge.

14. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.

15. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.

16. Provide cylindrical corrosion barriers for epoxy lined steel pipe 24-In. diameter and smaller, unless minimum wall thickness is 0.5-In. or greater.

    a. In addition to welding requirements contained here in Paragraph 3.06, conform to protection fitting manufacturer's installation recommendations.

    b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have 12 months prior experience installing protection fittings.

    c. All steel pipe is to have cutback ¾-In. to no greater than 1-In. of internal diameter coating from weld bevel.

    d. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension

length to measure no less than diameter of pipe. Shop apply lining in accordance with AWWA C 210 or AWWA C 213.

e. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.

D. Restrained Joints

1. For existing water lines and water lines less than 16-In. in diameter, restrain pipe joints with concrete thrust blocks. Suitable reaction blocking or anchorage shall be provided at all of the following; dead ends, plugs, caps, tees, crosses, valves, and bends.

2. Mechanical thrust restraint may be required in conjunction with thrust blocking as approved by Public Works. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer in the State of Texas for review by Public Works. Make adjustments in thrust restraint lengths at no additional cost to the City.

3. Passive resistance of soil will not be permitted in calculation of thrust restraint.

4. For 16-In. lines and larger use minimum 16-Ft. length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide restraint joints for a minimum length of 16-Ft. on each side of beveled joints.

5. Installation.

a. Install restrained joints mechanism in accordance with manufacturer's recommendations.

b. Examine and clean mechanism; remove dirt, debris and other foreign material.

c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.

d. Verify gasket is evenly seated.

e. Do not over stab pipe into mechanism.

6. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.

7. Place 3000 psi concrete conforming to Section 03315 - Concrete for Utility Construction, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type II cement, 2 days prior to hydrostatic testing of pipeline.

E. Joint Grout (Steel Pipe):

1. Mix cement grout mixture by machine except when less than 1/2 cubic yard is required. When less than 1/2 cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Retempering of grout by any means is not permitted.

2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without retempering. Use grout for filling grooves of such consistency that it will adhere to ends of pipe.

3. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.

4. Follow established procedures for hot and cold weather concrete placement.

5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.

6. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum 5/8-In. wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.

7. Interior Joints for Pipe 24-In. and Smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Public Works for 20-In. pipe and smaller.

8. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings, or by pointing with grout. Joint pointing may be omitted on potable water pipelines if joint bands are protected by zinc metallizing or other approved protective coatings.

9. Remove and replace improperly cured or otherwise defective grout.

10. Strike off grout on interior joints and make smooth with inside diameter of pipe.

11. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply approved flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.

12. Interior Joints for Water Lines 30-In. and Larger: Clean joint

space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from Public Works of inside joints before proceeding with next day's pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.

13. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.

G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately ½-In. wide and 0.015-In. thick, use other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. Perform tests at no additional cost to the City.

H. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by Public Works. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.

1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.

2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.

3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.

4. Replace, repair, or reapply coatings and linings as required.

5. Assessment of deflection may be measured by Public Works at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.

6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.

3.07 CATHODIC PROTECTION APPURTENANCES

A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on Drawings.

B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Public Works.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.08 SECURING, SUPPORTING AND ANCHORING

A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.09 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE

A. Double wrap pipe and appurtenances per Section 02501 – Ductile Iron Pipe and Fittings.

B. Do not use polyethylene wrap if pipe is cathodically protected.

C. Conform to requirements of Section 02528 - Polyethylene Wrap.

3.10 CLEANUP AND RESTORATION

A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.

B. Unless otherwise approved by Public Works, comply with the following;

1. Once water line is installed to limits approved in layout submitted, immediately begin preparatory work for disinfection effort.

2. No later than three days after completing disinfection preparatory work, submit to the City appropriate information relative to disinfection.

3. Once the procedure is approved complete the necessary disinfection procedures.

4. Immediately after transfer of services, begin abandonment of old water lines and site restoration.

5. Do not exceed a total of 50% of total project linear feet of disturbed right- of-way and easement until site is restored in accordance with Section 01740 - Site Restoration.

6. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

C. For large diameter water lines, do not install more than 2,000 –Ft. of water line, without previous 2,000-Ft. being restored in accordance with Section 01740 - Site Restoration. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1,000-Ft. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

3.11 CLEANING PIPING SYSTEMS

A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. The City must inspect water line for cleanliness prior to

filling.

3.12 DISINFECTION OF WATER LINES

A. Conform to requirements of Section 02514 - Disinfection of Water Lines.

3.13 FIELD HYDROSTATIC TESTS

A. Conform to requirements of Section 02515 - Hydrostatic Testing of Pipelines.

END OF SECTION

SECTION 02512

WATER TAP AND SERVICE LINE INSTALLATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tapping existing mains and furnishing and installing new service lines for water.

B. Relocation of existing small water meters.

C. Specifications identify requirements for both small-diameter (less than or equal to 16-In.) water lines and large-diameter (greater than 16-In.) water lines. When specifications for large-diameter water lines differ from those for small- diameter water lines, paragraphs for large-diameter water lines will govern for large-diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for water taps and copper service lines ¾-In. through 1-In. is on unit price basis for each installation. Separate measurements will be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.04, Definitions.

2. Payment for water taps and service lines 1 ½-In. through 2-In. is on unit price basis for each installation. Separate measurements will be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.04, Definitions.

3. Payment for "short side, "long side" and "extra long side" includes locating water line, tap installation and connection to meter and restoring site.

4. Payment for each small meter includes labor, materials, and equipment to relocate existing small meter.

5. No additional payment will be made for bedding, backfill, compaction, push under pavement, etc.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.

B. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-In.. Through 12-In., for Water Distribution.

1.04 DEFINITIONS

A. Short Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on same side of street.

B. Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of streets where supply line is located in street center such as boulevards and streets with esplanades. Distance not to exceed 60-Ft. (at right angles to water line).

C. Extra Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of streets where supply line is located in street center such as boulevards and streets with esplanades. Distance greater than 60-Ft. (at right angles to water line).

PART 2 PRODUCTS

2.01 MATERIALS

A. Copper Tubing: In accordance with Section 02503 - Copper Tubing. Polybutylene tubing is not permitted.

B. Corporation Stops: AWWA C 800 as modified in this Section:

1. Inlet End: AWWA standard thread.

2. Valve Body: Tapered plug type, O-ring seat ball type, or rubber seat ball type.

3. Outlet End: Compression type fitting.

C. Provide taps for water line types and sizes in accordance with pipe tapping schedule located at end of this Section.

D. Dual Strap Saddles: ductile-iron, epoxy-coated body and galvanized or

stainless-steel straps.

E. Taps for PVC Water Lines: Use dual-strap saddles which provide full support around circumference of pipe and bearing area of sufficient width along axis of pipe, 2-In. minimum, ensuring that pipe will not be distorted when saddle is tightened. Provide approved stainless-steel tapping saddle with AWWA standard thread.

F. Taps for Steel Pipe: Not allowed, unless specifically approved by Public Works. Use saddle only when tap is approved on steel pipe.

G. Curb Stops and Brass Fittings: AWWA C 800 as modified in this Section.

1. Inlet End: Compression-type fitting

2. Valve Body: Straight-through or angled, meter-stop design equipped with following:

a. O-ring seal straight plug type.

b. Rubber seat ball type.

3. Outlet End: Female, iron-pipe thread or swivel-nut, meter-spud thread on 3/4-In. and 1-In. stops and 2-hole flange on 1 1/2 and 2-In. sizes.

4. Fittings: Provide approved fittings. Use same size open end wrenches and tapping machines as used with respective Mueller fittings.

5. Factory Testing of Brass Fittings:

a. Submerge in water for 10 seconds at 85 psi with stop in both closed and open positions.

b. Reject fittings that show air leakage. Public Works may confirm tests locally. Entire lot from which samples were taken will be rejected when random sampling discloses unsatisfactory fittings.

H. Angle Stops: In accordance with AWWA C 800; ground-key, stop type with bronze lock- wing head stop cap; inlet and outlet threads conform to application tables of AWWA C 800; and inlets compression.

1. Outlet for 3/4-In. and 1-In. size: Meter swivel nut with saddle support.

2. Outlet for 1 1/2-In. through 2-In. size: O-ring sealed meter flange, cc

thread.

I. Fittings: In accordance with AWWA C 800 and following:

1. Castings: Smooth, free from burrs, scales, blisters, sand holes, and defects which would make them unfit for intended use.

2. Nuts: Smooth cast and has symmetrical hexagonal wrench flats.

3. Flare-Joint Fittings: Smooth cast. Machine seating surfaces for metal-to-metal seal to proper taper or curve, free from pits or protrusions.

4. Thread fittings, of all types, shall have N.P.T. or AWWA threads, and protect male threaded ends in shipment by plastic coating, or approved equal.

5. Compression tube fittings shall have Buna-N beveled gasket.

6. Stamp of manufacturer's name or trademark and of fitting size on body.

PART 3 EXECUTION

3.01 GENERAL

A. For service lines and lateral connections larger than those allowed in Pipe Tapping Schedule, branch connections and multiple taps may be used. Space corporation stops minimum of 2-Ft. apart.

B. Tapped collars of appropriate sizes: Approved in new construction only provided they are set at right angles to proposed meter location.

C. Use tapping machine manufactured for pressure tapping purposes for 2-In. and smaller service taps on pressurized water lines.

D. For new meter or when existing meter is in conflict with proposed pavement improvements, locate water meters one foot inside street right-of-way, or when this is not feasible, 1-Ft. on curb side of sidewalk. Contact Public Works when major landscaping or trees conflict with service line and meter box location. No additional payment will be made for work on customer side of meter.

E. New location and installation of existing small meter shall conform to requirements of this Section.

3.02 SERVICE INSTALLATION

A. Set service taps at right angles to proposed meter location and locate taps in upper pipe segment within 45 degrees of pipe springline.

B. Install service lines in open-cut trench in accordance with Section 02317 - Excavation and Backfill for Utilities. Install service lines under paved roadways, other paved areas and areas indicated on Drawings in bored hole in accordance with Paragraph 3.02 D.

C. Lay service lines with minimum of 30-In. of cover as measured from top of curb or, in absence of curbs, from centerline elevation of crowned streets or roads. Provide minimum of 18-In. of cover below flow line of ditches to service lines.

D. Service lines across existing street (push-unders): Pull service line through prepared hole under paving. Use only full lengths of tubing. Take care not to damage copper tubing when pulling it through hole. Compression-type union is only permitted when span underneath pavement cannot be accomplished with a full standard length of tubing. Use one compression-type union for each full length of tubing.

E. Maintain service lines free of dirt and foreign matter.

F. Install service lines so that top of meter will be 4 to 6-In. below finished grade.

G. Anticipate existing sanitary sewers to have cement stabilized sand or flowable fill backfill to bottom of pavement. Include cost of such crossings in unit price for services.

3.03 CURB STOP INSTALLATION

A. Set curb stops or angle stops at outer end of service line inside of meter box. Secure opening in curb stop to prevent unwanted material from entering. In close quarters, make S-curve in field. Do not flatten tube. In 3/4-In. and 1-In. services, install meter coupling, swivel-nut, or curb stop ahead of meter.

3.04 SEQUENCE OF OPERATIONS

A. Open trench for proposed service line in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Install curb stop on meter end of service line.

C. With curb stop open and prior to connecting service line to meter in slack position, open corporation stop and flush service line thoroughly. Close curb

stop, leaving corporation stop in full-open position.

D. Check service line for apparent leaks. Repair leaks before proceeding.

E. Schedule inspection with Public Works prior to backfilling. After inspection, backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

F. Install meter box centered over meter with top of lid flush with finished grade. Meter box: Refer to Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

Table 1 Table 02512-1 Pipe Tapping Schedule

Waterline Type and Diameter	**Service Size**	**Service Size**	**Service Size**	**Service Size**
	¾”	1”	1-1/2”	2”
4” Cast Iron or Ductile Iron	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
4” Asbestos Cement	WBSS	WBSS	DSS,	DSS,
4” PVC (AWWA C900)	DSS,	DSS,	DSS,	DSS
6” and 8” Cast Iron Or Ductile Iron	DSS,	DSS,	DSS,	DSS,
6” and 8” Asbestos Cement	DSS	DSS,	DSS,	DSS,
6” and 8” Cast Iron or Ductile Iron	DSS,	DSS,	DSS,	DSS,
6” and 8” PVC (AWWA C900)	DSS,	DSS,	DSS,	DSS,
12” Cast Iron or Ductile Iron	DSS,	DSS,	DSS,	DSS,
12” Asbestos Cement	DSS,	DSS,	DSS,	DSS,
12” PVC (AWWA C900)	DSS,	DSS	DSS,	DSS,
16” and Up Cast Iron Or Ductile Iron	DWBSS	DWBSS	DWBSS	DWBSS
16” and Up Asbestos Cement	DWBSS	DWBSS	DWBSS	DWBSS
16” and Up PVC (AWWA C900)	DWBSS	DWBSS	DWBSS	DWSBSS

DSS – DUAL STRAP SADDLES
WBSS – WIDE BAND STRAP SADDLES
DWBSS – DUAL WIDE BAND STRAP SADDLES

END OF SECTION

SECTION 02513

WET CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet connections for new water lines and service lines to existing water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for wet connections shown on Drawings is on unit price basis for each wet connection. Separate payment will be made for each size of water line.

2. No compensation will be given for extra work or for damages occurring as result of incomplete shutoff.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.

1.04 DEFINITIONS

A. Wet connections consist of isolating sections of pipe to be connected with existing valves, draining isolated sections, and completing connections.

B. Connection of 2-In. or smaller lines, which may be referred to on Drawings as "2-In. standard connections" or "gooseneck connections" will be measured as 2-In. wet connections. This item is not to be used as part of 2-In. service line.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe shall conform to requirements of applicable portions of Sections 02501 through 02528 related to piping materials and to water distribution.

B. Corporation cocks and saddles shall conform to requirements of Section 02512 - Water Tap and Service Line Installation.

C. Valves shall conform to requirements of Section 02521 - Gate Valves.

D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 EXECUTION

3.01 CONNECTION OPERATIONS

A. Plan wet connections in manner and at hours with least inconvenience public. Notify Public Works at least 72 hours in advance of making connections.

B. Do not operate valves on water lines in use by the City. The City of Schertz Utility Operations Division will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.

C. Conduct connection operations when Inspector is at job site. Connection work shall progress without interruption until complete once existing water lines have been cut or plugs have been removed for making connections.

3.02 2-IN. WET CONNECTIONS

A. Tap water line. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing water line. Use 2-In. valves when indicated on Drawings for 2-In. copper gooseneck connections.

END OF SECTION

SECTION 02514

DISINFECTION OF WATER LINES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disinfection of potable water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for disinfection of water lines under this Section. Include cost in unit price of water lines being disinfected.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to the City water distribution system.

B. Water for disinfection and flushing will be furnished by the City without charge.

C. Unless otherwise provided in Contract Documents, the Contractor will conduct disinfection operations.

D. Coordinate chlorination operations through Public Works.

3.02 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and

materials, and other items needed to facilitate disinfection of new water lines prior to connection to the City water distribution system. Normally, each valved section of water line requires two each 3/4-In. taps. A 2-In. minimum blow-off is required for water lines up to and including 6-In. diameter.

B. Use fire hydrants as blow-offs to flush newly constructed water lines 8-In. diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by Public Works. Average water velocity when filling pipeline should be less than 1-Ft. per second and shall not, under any circumstance, exceed 2-Ft. per second. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.

3.03 DISINFECTION BY CITY PERSONNEL

A. City personnel will not perform disinfection work.

3.04 DISINFECTION BY CONTRACTOR

A. Mains shall be disinfected with dry Calcium Hypochlorite (HTH) where shown on the plans or as directed by the Engineer. This method of disinfection will also be followed for main repairs. Introduce chlorinating material to water lines in accordance with AWWA C 651.

B. Dosage: The contractor shall disinfect the new or replaced mains with Calcium Hypochlorite (HTH) of seventy (70%) percent available chlorine. Sufficient Calcium Hypochlorite (HTH) shall be used to obtain a minimum chlorine concentration of 50 ppm (mg/l).

C. The length of time that sections of main disinfected with Calcium Hypochlorite shall be allowed to stand undisturbed will depend upon the particular job

1. The required minimum detention time will be eighteen (24) hours when circumstances permit a shutdown with no customers out of service with 50 ppm Chlorine dosage.

2. The required minimum detention time will be two (2) hours when customers are out of service during a shutdown with no leakage past valves with 300 ppm chlorine dosage.

3. The required minimum detention time will be thirty (30) minutes when customers are out of service during a shutdown with some leakage with 500 ppm chlorine dosage.

Table 1 Chlorine dosage

Diameter of Pipe Inches	Ounces Per Foot To Obtain 50 ppm Chlorine Dosage
6	0.0138
8	0.0233
10	0.0364
12	0.0523
14	0.0708
16	0.0934
18	0.1175
20	0.1455
24	0.2080
30	0.3270
36	0.4690
42	0.6370
48	0.8330

A heaping teaspoon holds approximately 1/2 ounce, and a standard measuring cup holds approximately 8 ounces

4. Open and close valves in lines being sterilized several times during contact period.

5. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 0.3 ppm, in accordance with Section 02515 Hydrostatic Testing of Pipelines

.

6. Backflow prevention valve shall be required so that the strong chlorine solution in the line being tested will be flushed out of the main and will not flow back into the line supplying the water.

3.05 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines, bacteriological tests will be performed by the Contractor or testing laboratory in accordance with Section 01454 - Testing Laboratory Services. One bacteriological sample per one thousand (1,000') feet of new line shall be taken, plus one set from each branch and one set from the end of the line.

B. When test results indicate need for additional disinfection of water lines based upon the Texas Department of Health requirements, perform necessary additional disinfection operations.

3.06 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION

SECTION 02515

HYDROSTATIC TESTING OF PIPELINES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field hydrostatic testing of newly installed water pipelines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for hydrostatic testing of pipelines under this Section. Include cost in unit price of pipelines being tested.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Disinfect water system pipelines prior to hydrostatic testing.

B. Hydrostatically test newly installed water pipelines after disinfection, when required, and before connecting to the City water distribution system.

C. Water for testing will be provided to Contractor at no charge. Prior to hydrostatic testing, obtain a transient meter from the City. Deposit is required for transient meter.

D. Test pipelines in lengths between valves, or plugs, of not more than 2,000-ft. unless approved by Public Works.

E. Conduct hydrostatic tests in presence of Public Works.

3.02 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

B. Allow pipeline to sit minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.

C. For all water lines, expel air and apply minimum test pressure of 200 psi. During the test, pressures shall not vary more than ±5 psi.

D. Begin test by 9:00 a.m. unless otherwise approved by Public Works. Maintain test pressure for typically 4 hours, a minimum 2 hours if approved by Public Works. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.

E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.03 ALLOWABLE LEAKAGE FOR WATERLINES

A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.

B. Maximum allowable leakage for water lines with rubber gasketed joints will be according to AWWA 600 for 200 psi:

Max Allowable Leakage Rate (gal/hr) = $(L \times D \times \sqrt{P}) / 148{,}000$

where L is length of test section in feet, and D is nominal diameter in inches, P is test pressure (psi)

C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by Public Works for leakage during pressure test may be used to fulfill requirements of this section.

3.04 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. Public Works may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Section 02514 - Disinfection of Water Lines. Pay for water required for additional disinfection and retesting.

C. Repeat test until satisfactory results are obtained.

3.05 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION

Table 1 Maximum allowed leakage rate (gal/hr) for hydrostatic testing at 200 psi.

Pipe Dia. in	Pipe Length, feet										
	100	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**	**2000**
6	0.06	0.11	0.17	0.23	0.29	0.34	0.4	0.46	0.52	0.57	1.15
8	0.08	0.15	0.23	0.31	0.38	0.46	0.54	0.61	0.69	0.76	1.53
10	0.1	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.96	1.91
12	0.11	0.23	0.34	0.46	0.57	0.69	0.8	0.92	1.03	1.15	2.29
14	0.13	0.27	0.4	0.54	0.67	0.8	0.94	1.07	1.2	1.34	2.68
16	0.15	0.31	0.46	0.61	0.76	0.92	1.07	1.22	1.38	1.53	3.06
18	0.17	0.34	0.52	0.69	0.86	1.03	1.2	1.38	1.55	1.72	3.44
20	0.19	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	3.82
24	0.23	0.46	0.69	0.92	1.15	1.38	1.61	1.83	2.06	2.29	4.59
30	0.29	0.57	0.86	1.15	1.43	1.72	2.01	2.29	2.58	2.87	5.73
36	0.34	0.69	1.03	1.38	1.72	2.06	2.41	2.75	3.1	3.44	6.88
42	0.4	0.8	1.2	1.61	2.01	2.41	2.81	3.21	3.61	4.01	8.03

SECTION 02516

CUT, PLUG AND ABANDONMENT OF WATER LINES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cut, plug and abandonment of water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for cut, plug, and abandonment of water lines is on a unit price basis for each cut, plug, and abandonment performed. Separate payment will be made for each size of water line.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed plugs and clamps for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete for reaction blocks: Class B conforming to requirements of Section 03315 - Concrete for Utility Construction.

B. Plugs and clamps: Applicable for type of pipe to be plugged.

PART 3 EXECUTION

3.01 APPLICATION

A. Do not begin cut, plug and abandonment operations until replacement water line has been constructed, disinfected, and tested, and service lines have been transferred to replacement water line.

B. Install plug, clamp, and concrete reaction block and make cut at location shown on Drawings.

C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than at supply water line or as shown on Drawings.

D. After water line to be abandoned has been cut and plugged, check for other sources feeding abandoned water line. When sources are found, notify Public Works immediately. Cut and plug abandoned water line at point of other feed as directed by Public Works.

E. Plug or cap ends or openings in abandoned water line in manner approved by the Public Works.

F. Remove and dispose of surface identifications such as valve boxes and fire hydrants. Valve boxes in improved streets, other then shell, may be filled with concrete after removing cap.

G. Backfill excavations in accordance with Section 02317 - Excavation and Backfill for Utilities.

H. Repair street surfaces in accordance with Section 02951- Pavement Repair and Resurfacing.

END OF SECTION

SECTION 02517

HANDLING ASBESTOS CEMENT PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This item shall govern for the removal, handling, disturbance, and disposal of asbestos cement (AC) pipe and other asbestos containing materials (ACM) related to the AC pipe work. AC pipe is also known as transite pipe. Since buried AC pipe typically contains approximately 15% to 20% chrysotile and crocidolite asbestos, it is considered to be an asbestos-containing material. The material is classified as non-friable, unless broken at which time its classification changes to friable ACM. The removal and/or disturbance of this material is governed by the National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the Occupational Safety and Health Administration (OSHA).

B. This item shall consist of the handling, disturbance, removal and disposal of AC water pipe, joints, wrappings and other ACM. In order to comply with NESHAP and OSHA regulations, this project will require workers with specialized training using wet work procedures to cut and remove AC pipe, AC pipe joints, valves (any type) containing ACM and surrounding soils containing ACM. A Texas Department of Health (TDH) licensed Asbestos Consultant shall develop the asbestos work practices and monitoring in the Contractor's Health & Safety Plan to be reviewed by Public Works representatives. <u>It is the contractor's responsibility to obtain the services of a licensed Asbestos Consultant authorized in the State of Texas and this work shall be considered subsidiary to this item.</u> Any other ACM encountered that has not been identified by the Inspector or not shown on plans will be not be authorized for payment. Any other disturbance, handling, or disposal of AC water pipe that is necessary due to authorized work by any other agency will be paid for by that agency under a different special specification and a different bid item number.

1.02 MEASURMENT AND PAYMENT

A. There are various bid items that require the contractor to perform work on existing AC pipes. The work performed as prescribed by these items in Section 02517 shall be paid for as subsidiary to the bid item wherein the work is required. Prices shall be full compensation for the work herein specified including the furnishing of all materials, equipment, tools and for the material disposal, submittals, labor and air monitoring necessary to complete the work.

1.03 DEFINITIONS

The following terms are defined for the nature of this work.

A. Air Monitoring - The process of measuring the fiber concentration of a known volume of air collected during a specific period of time. The analysis procedure utilized for asbestos is the NIOSH Standard Analytical Method for Asbestos in Air, Method 7400. Transmission electron microscopy (TEM) may be utilized for lower detection limits and/or specific fiber identification.

B. Air Monitoring Technician - The person licensed by the Texas Department of Health to conduct air monitoring for an asbestos abatement project or related activity. The Air Monitoring Technician may only obtain air samples, and may only perform analysis of air samples with an upgraded Air Monitoring Technician License, which includes completion of the NIOSH-582 equivalent course. The air-monitoring technician shall be an employee of a licensed asbestos laboratory or a licensed Asbestos Consultant agency.

C. Amended Water - Water to which a surfactant has been added.

D. Asbestos - The asbestiform varieties of serpentines and amphiboles. Specifically, chrysotile, crocidolite, grunerite, amosite, anthophyllite, actinolite, and tremolite.

E. Asbestos Containing Material (ACM) - Material or products that contain more than 1.0% of any kind of asbestos.

F. Asbestos Containing Waste Material - asbestos containing material or asbestos contaminated objects requiring disposal

G. Authorized Personnel - Any person authorized by the Contractor and required by work duties to be present in the work area or other regulated areas.

H. Authorized Visitor – City of Schertz representatives, and any representative of a regulatory or other agency having jurisdiction over the project.

I. Asbestos Consultant - That person licensed by the Texas Department of Health to perform the following asbestos related functions:
(1) Project design; (2) Asbestos surveys and condition assessment of ACM; (3) Asbestos Management Planning; (4) The collection of bulk material samples, airborne substance samples and the planning of sampling strategies; (5) Owner-representative services for asbestos abatement projects or O&M programs, including air monitoring and project management; (6) Consultation regarding regulatory compliance and all aspects of technical specifications and contract documents; and (7) The

selection, fit testing, and appropriate use of personal protection equipment and the development of asbestos related engineering controls.

J. Abatement Contractor - The company, agency, or entity licensed by the Texas Department of Health that has been retained by City of Schertz or the Contractor to perform asbestos abatement and other associated functions.

K. Class II Asbestos Work (OSHA Standard) – Activities involving the removal of ACM, which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

L. Competent Person – One who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them.

M. Encapsulant - A specific adhesive designed to lock down and minimize the fiber release of asbestos containing materials and asbestos contaminated materials.

N. Friable Asbestos - Asbestos-containing material, which can be crumbled to dust, when dry, under hand pressure, and includes previously non-friable material after such previously non-friable material becomes damaged to the extent that, when dry, it may be crumbled, pulverized, or reduced to powder by hand pressure.

O. HEPA Filter - A high efficiency particulate air filter capable of removing particles > 0.3 microns in diameter with 99.97% efficiency.

P. NESHAP - The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

Q. NIOSH - The National Institute for Occupational Safety and Health.

R. OSHA - The Occupational Safety and Health Administration.

S. Regulated Area – An area established by the Contractor to demarcate areas where asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

T. Regulated Asbestos-containing Material (RACM) – (1) Friable asbestos material; (2) Category I non-friable ACM that has become friable; (3)

Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or, (4) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by forces expected to act on the material in the course of the demolition or renovation operations regulated by 40 CFR Part 61, Subpart M.

U. Staging area – A pre-selected area where containerized asbestos containing waste material will be placed prior to removal from the project site.

V. Surfactant - A chemical wetting agent added to water to improve penetration.

1.04 REFERENCECES

A. All work under these specifications shall be done in strict accordance with all applicable Federal, State, and local Regulations, standards, and codes governing asbestos abatement and any other trade work done in conjunction with the asbestos abatement. Work activities must also comply with these and other City of Schertz Specifications related to health and safety. The most recent edition of any relevant regulation, standard, or code shall be in effect. Where there exists conflict between the regulations, standards, codes, or these specifications, the most stringent requirements shall be utilized. The Contractor shall comply with, at minimum, the following specific regulations:

1. Occupational Safety and Health Administration (OSHA) including but not limited to:

   a. Title 29 Code of Federal Regulations Section 1910.1001 - General Industry Standard for Asbestos.

   b. Title 29 Code of Federal Regulations Section 1910.134 - General Industry Standard for Respiratory Protection.

   c. Title 29 Code of Federal Regulations Section 1926 - Construction Industry.

   d. Title 29 Code of Federal Regulations Section 1910.2 - Access to Employee Exposure and Medical Records.

   e. Title 29 Code of Federal Regulations Section 1910.1200 - Hazard Communication.

2. Environmental Protection Agency (EPA) including but not limited to:

a. Title 40 Code of Federal Regulations Part 61 Subpart M - National Emission Standard for Asbestos.

3. Texas Department of Health including but not limited to:

a. Texas Department of Health - Texas Administrative Code, Title 25, Chapter 295, Subchapter C - Texas Asbestos Health Protection.

b. Texas Department of Health - Texas Administrative Code, Title 25, Chapter 325 - Texas Solid Waste Regulations.

c. Texas Department of Health - Texas Civil Statutes, Article 4477-A, Section 12, General Provisions 295.31 to 295.73.

4. American National Standards Institute (ANSI)

5. American Society for Testing and Materials (ASTM)

6. Department of Transportation - HM 181

1.05 SUBMITTALS AND NOTICES

A. At the Pre-construction Conference/Meeting, all training records, certifications, medical records, and laboratory qualifications will be submitted for review to Public Works representatives as well as the following:

1. In order to comply with the City of Schertz Project Construction Health and Safety Program requirements for any project with the potential to involve friable ACM, the Contractor will be responsible for developing and implementing an asbestos removal work plan in accordance with NESHAP, OSHA. As such, Contractors submitting bids for the project must have a Texas Department of Health (TDH) licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Plans submitted by the Asbestos Consultant must include the person or firms name, address, phone number and TDH certification. Health and Safety plans for working with ACM must address the guidance provided in these special specifications. The guidance provided in this special specification is not intended and does not constitute asbestos abatement project design as described under TAC 25, Chapter 295.47 (TDH asbestos regulations).

2. Submit documentation satisfactory to Public Works that an Initial and/or Negative Exposure Assessment in accordance with OSHA Standard 29 CFR 1911 has or will be performed (as applicable).

3. Submit documentation satisfactory to Public Works that the Contractor's employees, including foremen, supervisors and any other company personnel or agents who may be exposed to airborne asbestos fibers or who may be responsible for any aspects of asbestos disturbance activities, have received adequate training in compliance with applicable rules and regulations.

4. Submit documentation to Public Works of a respiratory protection program for affected employees as per OSHA Standard 29 CFR 1910.134.

5. Submit documentation to Public Works from a physician that all personnel who may be required to wear a respirator are medically monitored to determine whether they are physically capable of working while wearing the required respiratory protection without suffering adverse health effects. In addition, document that personnel have received medical monitoring as is required in compliance with applicable rules and regulations.

6. Submit to Public Works representative's documentation of respirator fit testing for all Contractor employees and agents who must enter the work area. This fit testing shall be in accordance with qualitative procedures as detailed in the OSHA Standard 29 CFR 1910.134. Optionally, the fit testing may be quantitative in nature.

7. Name of OSHA monitoring Consultant/Lab. The Contractor will be responsible for air monitoring as required to meet OSHA Requirements.

8. Submit proof satisfactory to Public Works that required permits, site location and arrangements for transport and disposal of asbestos containing waste materials have been made.

B. During Asbestos Disturbance Activities:

1. Submit copies to Public Works of all transport manifests, trip tickets, and disposal receipts for all asbestos waste materials removed from the work area during the project. The Contractor will sign manifests as the City's representative (generator) for the AC pipe and provide copies to Public Works for final payment.

2. Upon completion of the AC pipe project an abatement report shall be required by the contractor's asbestos consultant. Copies of the final abatement report shall be prepared and submitted to Public Works by the contractor's consultant.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. The Work includes all Work specified herein, to include mobilization and demobilization, labor, materials, overhead, profit, taxes, transportation, disposal fees, administrative fees incidental cost, etc. Estimating areas, quantities, weight, etc., are the sole responsibility of the Contractor.

B. To meet and/or exceed NESHAP and OSHA guidelines, the contractor will subcontract the AC water pipe handling to an Environmental Protection Agency (EPA) accredited and TDH licensed Asbestos Abatement Contractor and TDH Licensed Asbestos Consultants.

1. An alternative method would entail the disturbance, handling, repair, and disposal of the AC pipe by an authorized TDH licensed worker with the required course of an asbestos worker awareness class or a TDH required asbestos training course preparing workers to handle disturbed ACM. Review of the asbestos work practices and monitoring in the Contractor's Health & Safety Plan will still need to be performed by a licensed TDH Asbestos Consultant.

2. NESHAP guidelines apply to projects with at least 260 linear feet or 35 cubic feet or 160 square feet. NESHAPS also applies when AC pipe becomes or will become "regulated asbestos containing material" or RACM. This means that if at least 260 linear feet of the AC pipe has become crushed, crumbled, or pulverized, then the project is subject to the NESHAP. If the Texas Department of Health (TDH) limit of 260 LF is exceeded, it will be the responsibility of the contractor for the TDH administrative fee. The asbestos consultant shall be responsible for submitting the TDH notification with copies also submitted to Public Works Department, if the quantity of 260 LF is exceeded.

3. During the disjoining operation of AC pipe removal, only the portion that has become RACM would be counted toward the threshold amount if the debris caused by the disjoining operation is cleaned up so that it does not contaminate a greater length of pipe. If the generated AC pipe debris is not properly cleaned up, then the AC

pipe must be considered contaminated, and the whole length is treated as asbestos-containing waste material. If the scope of this project may involve the threshold amount (260 linear feet or greater), then a Demolition/Renovation Notification Form will need to be sent to TDH by the Contractor. This form will need to be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

4. All AC pipe projects will require that NESHAP and OSHA guidelines are met and/or exceeded in areas where AC pipe is to be disturbed. This means that all AC pipe disturbance will require a third party TDH licensed asbestos consultant and asbestos contractor on-site during AC pipe disturbance. An asbestos abatement work plan shall be provided to Public Works representatives by both the licensed asbestos consultant and asbestos contractor. Upon completion of the AC pipe project an air monitoring abatement report shall be required by the contractor's asbestos consultant. Copies of the final abatement report shall be prepared and submitted to Public Works by the contractor's consultant. OSHA requires that during any ACM disturbance, regardless of amount, the asbestos worker(s) shall be properly protected during potential asbestos exposure, 29 CFR, Subpart Z, 1910.1101.

C. The Contractor shall remove, seal, transport and dispose of all impacted asbestos-containing materials in compliance with all current Federal, State and local regulations, laws, ordinances, rules, standards and regulatory agency recommended requirements. Asbestos disturbance and/or removal activities shall be conducted by properly trained, accredited, and licensed personnel using proper personal protective equipment.

D. The Contractor shall notify City representatives at least 72 hours in advance prior to beginning removal and/or disturbance of the AC pipe. AC pipe disturbance shall be conducted during regular business hours, Monday-Friday. No weekend work of AC pipe disturbance is allowed, unless special circumstances require the contractor to do so.

E. Time is of the essence in removing the asbestos-containing materials from the project area. All work must be completed within the time period specified. Public Works representatives will be responsible for coordinating this work in high-density areas, such as schools, church facilities, and residential areas.

F. All required notifications required to state regulatory agencies will be made by the Contractor with copies provided to Public Works representatives, including but not limited to the TDH Demolition/Renovation Notification Form. If 260 linear feet or greater of AC pipe will become crushed, crumbled or pulverized, then the project is subject to NESHAP regulations

and a Demolition/Renovation Notification Form will need to be sent to TDH by the Contractor. This form will need to be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

G. The Contractor shall have an on-site supervisor, who is an OSHA Competent Person, present on the job site at all times that the work is in progress. This supervisor shall be thoroughly familiar with and experienced at asbestos disturbance and other related work and shall be familiar with and shall enforce the use of all safety procedures and equipment. He shall be knowledgeable of all applicable EPA, OSHA, NIOSH and TDH requirements and guidelines.

H. Prior to commencing any preparation of the work areas for asbestos disturbance, the Contractor shall post all required documents, warning signs and, as necessary, erect physical barriers in order that the work area may be secured.

I. The Contractor has sole and primary responsibility for the “means and/or methods” of the work and obligation to the City to make inspections of the work at all stages and has sole responsibility to supervise the performance of the work. Certain work practices for AC pipe disturbance are prohibited as per Section 02517.10.B.1.

J. The Contractor shall be responsible for site safety and for taking all necessary precautions to protect the Contractor’s personnel, City personnel and the public from asbestos exposure and/or injury. The Contractor shall be responsible for maintaining the integrity of the work area.

K. The Contractor shall confine operations at the site to the area requiring disturbance of AC pipe and the general site area associated with the proximity of the project. Portions of the site beyond areas on which the indicated work is required are not to be disturbed. The Contractor will not unreasonably encumber the site with materials or equipment. If asbestos containing waste materials are required to be stored overnight, it will be properly labeled, secured, and containerized to preclude unauthorized disturbance of the waste materials.

L. The Contractor shall be responsible for the transport and disposal of asbestos containing waste materials to a duly licensed landfill facility permitted to accept asbestos waste. The Contractor shall be responsible for obtaining and coordinating waste disposal authorization from a TCEQ licensed landfill. Waste manifests shall be used to transport the AC pipe from the project site to the final landfill disposal site. The Contractor will sign manifests as the City’s representative (generator) for the AC pipe and provide copies to Public Works for final payment.

3.02 SITE SECURITY

A. The Contractor shall demarcate the area of AC pipe disturbance ("regulated area") with barrier tape and warning signs, as per OSHA regulation 29 CFR 1926.1101. Access to the regulated area will be limited to only authorized personnel. Authorized personnel will have to have asbestos awareness training, respiratory training, etc. including City personnel.

B. Entry into the work area by unauthorized individuals shall be reported immediately to Public Works representatives by the Contractor.

C. A logbook shall be maintained immediately outside of the regulated area. Anyone who enters the regulated area must record name, affiliation, time in, and time out for each entry

3.03 PERSONAL PROTECTIVE EQUIPMENT

A. All work which will or may disturb asbestos-containing materials as specified shall be accomplished utilizing, as a minimum disposal suits with protective head cover, gloves, boots, eye protection, proper respiratory protection, decontamination by HEPA vacuuming and/or wet methods and wet wiping all equipment. The Contractor shall provide hard hats and/or other protection as required for job conditions or by applicable safety regulations. Disposal suits consisting of material impenetrable by asbestos fibers shall be provided to all workers and authorized visitors in sizes adequate to accommodate movement without tearing. Workers will be provided protective clothing from the time of first disturbance of asbestos-containing or contaminated materials until final cleanup is completed.

B. Respiratory Protection: The Contractor shall use removal techniques, methods and equipment which will not permit the fiber count to exceed the OSHA Permissible Exposure Level (PEL) of 0.1 fibers per cubic centimeter (f/cc) of air as detected by personal air sampling methods. Any remedial measures taken by the Contractor to meet this requirement will be at the Contractor's expense.

1. The Contractor's Competent Person shall ensure use of the appropriate respiratory protection for the work being performed. For minimum legal respiratory requirements, see OSHA Standards 29 CFR 1910.134, 29 CFR 1910.1001, and 29 CFR 1926.1101. All respiratory equipment, such as respirators, filters, etc. shall be certified by the National Institute of Occupational Safety and Health (NIOSH) for use in asbestos contaminated atmospheres.

2. The Contractor's Competent Person shall perform an Initial and/or Negative Exposure Assessment, which shall be performed on employees who have been trained in compliance with the OSHA regulations. Employees' exposures shall be collected using objective data that is to demonstrate whether the materials specified for removal can release airborne fibers in concentration levels exceeding 0.1 fibers per cubic centimeters (f/cc) during an eight-(8) hour time weighted average (TWA) and the excursion limit of 1.0 f/cc. For the purpose of the assessment, the work conditions should be those having the greatest potential for releasing asbestos fibers. Removal methods using conventional hand tools shall be performed in an area that requires a minimum of a seven-(7) hour work shift with employees performing functions normally required for a total project. Removal, for the purposes of the assessment, should be performed with methods most likely to release fibers and that do not render the asbestos-containing materials friable. Properly trained employees shall wear proper protective clothing and respirators during the assessment. Initial and/or Negative Exposure Assessments shall be performed in accordance with OSHA Standard 29 CFR 1926.1101.

   The development of the Health & Safety Plan by the Contractor's TDH licensed Asbestos Consultant shall include determining the adequacy of the Contractor's air monitoring data (which must performed within the previous 12 months of the project start date) for the Initial and/or Negative Exposure Assessment, based in part on site-specific factors such as changes in personnel or work methods used during AC pipe removal. If this type of air monitoring data needs to be reviewed during the course of a project, the Contractor's Asbestos Consultant shall review the data in order to determine if it is adequate. Any downgrade in personal protective equipment related to asbestos exposure shall be requested in writing to Public Works, and approved by a TDH licensed Asbestos Consultant. This request may be granted only when all regulations and pertinent sections of this special specification for respiratory protection are met.

3. The Contractor shall begin AC pipe removal operations (i.e., breaking, sawing, cutting, or repairing the pipe) in powered air purifying respirators (PAPRs) equipped with dual HEPA filters. PAPRs will be utilized until such time that air monitoring results indicate that half-face respirators may be used. Any changes (downgrade or upgrade) in respiratory protection will be based upon an 8-hour time weighted average (TWA) of fiber concentrations in the regulated area. Eight hour TWA's will be calculated daily by the Contractor's OSHA monitoring firm, for personal samples. The highest calculated 8 hour TWA shall be used to determine the type of

respirator to be worn. The type of respirators worn will be selected in accordance with 29 CFR 1926.1101 (h) (3).

The Contractor may request a respiratory protection downgrade, approved by a TDH licensed Asbestos Consultant, in writing to Public Works Department when all regulations and pertinent sections of this special specification for respiratory protection are met.

4. Workers shall be provided with personally issued, individually identified respirators.

5. No one wearing a beard shall be permitted to wear a respirator.

3.04 AIR MONITORING

A. Personal Air Monitoring: The Contractor shall provide personal air sampling as required by OSHA regulations. The OSHA TWA permissible exposure limit (PEL) for asbestos (0.1 f/cc) shall not be exceeded. Personal air samples shall be obtained by a TDH licensed Asbestos Air Monitoring Technician and analyzed by an accredited, independent TDH licensed Phase Contrast Microscopy (PCM) laboratory. OSHA monitoring results shall be posted at the project site and made available to all affected Contractor personnel on a daily basis.

B. The Contractor shall provide, as a minimum, personal air monitoring on each worker who is cutting, (wet) sawing, breaking, or repairing the AC pipe.

C. Area Air Monitoring: At any time that visible airborne fibers are generated or that wet work procedures are not used, all work will immediately cease until air monitoring by a TDH-licensed Asbestos Consultant Agency has started. The Contractor’s on-site Competent Person shall be responsible for making this determination; however, periodic, random site visits by Public Works will field-verify the objectivity of the Competent Person in these matters. Once initiated, the sampling and frequency of the area air monitoring will be dependent upon on the specific work practices being used by the workers at that time. However, the area air monitoring shall include, as a minimum, samples collected inside the regulated area, and upwind and downwind of the regulated area. The TDH licensed Asbestos Consultant Agency hired by the Contractor shall determine the need for additional samples and shall amend the Health & Safety Plan (with a copy to Public Works) to include sampling protocols.

D. Area air monitoring shall be conducted in accordance with applicable Federal, State, and local requirements. The cost of area air monitoring due

to failure to use adequate wet work procedures will be borne by the Contractor. Copies of all results will be provided to Public Works.

E. Area air sampling shall be mandatory in high density areas such as schools, residential areas, and certain other locations as determined by Public Works and made clear in individual City bid documents/plans.

3.05 EMPLOYEE TRAINING

A. Training shall be provided by the Contractor to all employees or agents who may be required to disturb asbestos containing or asbestos contaminated materials for AC pipe handling and auxiliary purposes and to all supervisory personnel who may be involved in planning, execution or inspection of such projects. The training shall be in accordance with OSHA Standard 29 CFR 1926.1101 for “Class II asbestos work”.

B. At a minimum, Contractor employees who will be potentially exposed to asbestos shall have completed within the last 12 months, an 8-hour Asbestos Awareness training course taught by a TDH licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos and work practices related to the handling of AC pipe.

C. The Contractor’s Competent Person shall have completed within the last 12 months, a 40-hour Asbestos Contractor Supervisor training course taught by a TDH licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos, employee personal protective equipment, medical monitoring requirements for workers, air monitoring procedures and requirements for workers, work practices for asbestos abatement, personal hygiene procedures, special safety hazards that may be encountered, and other topics as required.

3.06 AC PIPE HANDLING

A. General: The Contractor shall properly remove, handle, transport and dispose of all AC pipe specified in the City’s bid documents/plans for this project. All work involving AC pipe and other ACM products must be addressed in Health and Safety Program documents submitted to City representatives. To comply with the City’s Project Construction Health and Safety Program, Contractors submitting bids for the project must have a TDH licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety Program plans are to include provisions for the discipline of any worker failing to use wet work procedures or failing to use designated personnel protective equipment.

The Contractor shall remove ACM with wet methods or by other controlled techniques approved by the TDH, EPA, and OSHA and in accordance with these specifications and the Contractor-provided Health & Safety Plan. Alternative removal methods must be approved at time of the Contractor's submittals. The Contractor shall take special care to prevent damage to the adjacent structures, materials and finished materials not required for demolition to access ACM.

The Contractor shall limit his use of the premises to the work area indicated. Access to the work area shall be controlled by the Contractor. All electrical equipment, etc., shall have ground fault circuit interrupter (GFCI) protection. The Contractor shall properly demarcate, barricade and contain the work and/or regulated areas.

The work consists of providing GFCI protection, the use of approved equipment with engineering controls, sufficiently wetting the asbestos-containing materials using a surfactant or lock-down encapsulant, removing the asbestos-containing materials, HEPA vacuuming the work area, wet wiping the work area, double-bagging/double-wrapping the waste and removing carefully as indicated herein and in accordance with the Contractor-provided Health & Safety Plan.

B. Equipment: Equipment used to cut, break, or otherwise disturb AC pipe and associated asbestos-containing materials may include, but are not limited to: wet-cutting saws, saws equipped with point of cut ventilator (saw equipped with a water mister) or enclosures with HEPA filtered exhaust air, snap cutters, manual field lathes, pressure and non-pressure tapping devices.

Equipment used to either control visible emissions of fibers, contain the work area, or facilitate the clean-up of debris may include, but are not limited to: airless spray equipment, pump-up sprayers, surfactant, lock-down encapsulant, HEPA vacuums, brushes, brooms, shovels, disposable rags, polyethylene sheeting of 6-mil thickness, moisture resistant duct tape, asbestos warning signs, notices and barrier tape.

Alternative dismantling equipment may be substituted for the materials indicated herein, but must be approved by the Public Works Department.

1. Prohibited Work Practices and Engineering Controls: the following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM, regardless of asbestos exposure or the results of Initial Exposure Assessments:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

b. Other high-speed abrasive tools, such as disk sanders.

c. Carbide-tipped cutting blades.

d. Electrical drills, chisels, and rasps used to make field connections in AC pipe.

e. Shell cutters used to cut entry holes in AC pipe.

f. A hammer and chisel used to remove couplings or collars on AC pipe.

g. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud generated by the compressed air.

h. Dry sweeping, dry shoveling or other dry clean-up of dust and debris containing ACM.

i. Employee rotation as a means of reducing employee exposure to asbestos.

C. General Removal Work Practices: AC pipe has been identified as a non-friable ACM with the potential to become friable ACM. The material is classified as non-friable, unless broken at which time its classification changes to friable. NESHAP guidelines apply to projects with at least 260 linear feet or 35 cubic feet or 160 square feet. NESHAPS also applies when AC pipe becomes or will become “regulated asbestos containing material” or RACM. This means that if at least 260 linear feet of the AC pipe has become crushed, crumbled, or pulverized, then the project is subject to the NESHAP. During the disjoining operation of AC pipe removal, only the portion that has become RACM would be counted toward the threshold amount if the debris caused by the disjoining operation is cleaned up so that it does not contaminate a greater length of pipe. If the generated AC pipe debris is not properly cleaned up, then the AC pipe must be considered contaminated, and the whole length is treated as asbestos-containing waste material. If the scope of this project may involve the threshold amount (260 linear feet or greater), then a Demolition/Renovation Notification Form will need to be sent to TDH by the Contractor. This form will need to be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

All AC pipe projects will require that NESHAP and OSHA guidelines are met and/or exceeded in areas where AC pipe is to be disturbed. This means that all AC pipe disturbance will require a third party TDH licensed asbestos consultant and asbestos contractor on-site during AC pipe disturbance. An asbestos abatement work plan shall be provided to SAWS and City representatives by both the licensed asbestos consultant and asbestos contractor. Upon completion of the AC pipe project an air monitoring abatement report shall be required by the contractor's asbestos consultant. Copies of the final abatement report shall be prepared and submitted to Public Works representatives by the contractor's consultant. OSHA requires that during any ACM disturbance, regardless of amount, the asbestos worker(s) shall be properly protected during potential asbestos exposure, 29 CFR, Subpart Z, 1910.1101.

In order to comply with the City's Project Construction Health and Safety Program requirements for any project with the potential to involve friable ACM, the Contractor will be responsible for developing and implementing an asbestos removal work plan in accordance with NESHAP, OSHA, and state requirements. As such, Contractors submitting bids for the project must have a TDH licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety plans for working with ACM must address the guidance provided in these special specifications.

D. A sufficient supply of disposable rags for work area decontamination shall be available.

E. Disposal bags for RACM shall be of true 6-mil polyethylene, pre-printed with labels as required by EPA regulation 40 CFR 61.152 (b)(i)(iv) or OSHA requirement 29 CFR 1926.1101(k)(8).

F. Stick-on labels identifying the Generator's name (City of Schertz) and address and the project site location shall be applied to any asbestos waste bags that contain RACM, as per EPA or OSHA and Department of Transportation HM 181 requirements.

G. Work Area Preparation: Post warning signs and barrier tape meeting the specification of OSHA 29 CFR 1910.1001 and 40 CFR 61 at any location and approaches to a location where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far enough away from the work area to permit an employee to read the sign and take the necessary protective measures to avoid exposure. Maintain constant security against unauthorized entry past warning signs and barrier tape. Signs will be in both English and Spanish.

H. Personnel exit procedures

1. Before leaving the work area all personnel shall remove gross contamination from the outside of respirators and protective clothing by brushing and/or wet wiping procedures. (Small HEPA vacuums with brush attachments may be utilized for this purpose.) Adequate washing facilities shall be provided and utilized on-site.

2 Upon completion of the work, contaminated gloves shall be disposed of as asbestos contaminated waste. Disposable cloth gloves may be substituted for leather gloves, at the Contractor's discretion. (Rubber boots may be decontaminated at the completion of the project.)

I. Specific Removal Work Practice Requirements

1. The Contractor has sole and primary responsibility for the "means and/or methods" of the work and obligation to the City to make inspections of the work at all stages and has sole responsibility to supervise the performance of the work.

2. The Contractor shall isolate the regulated area with barrier tape and asbestos warning signs.

3. The Contractor shall lay and secure 6-mil polyethylene sheeting on the ground on both sides of the AC pipe for the length of the work area.

4. Working within the regulated area, using wet removal methods, the Contractor shall thoroughly soak each section of AC pipe to be disturbed, prior to any removal activity, with a surfactant or lock-down encapsulant. The Contractor shall use equipment capable of producing a "mist" application to reduce the potential for release of fibers. The Contractor shall take care to use as much encapsulant or surfactant as needed in order to lockdown possible fallout debris from edges and joints during removal. Provide continuous wetting of the materials throughout the entire removal process. The Contractor shall take care to limit the breakage of asbestos containing materials and remove these materials as intact as possible.

5. Any AC pipe debris on adjacent surfaces shall be removed. The Contractor shall promptly clean up asbestos wastes and debris following AC pipe disturbance. Remove and containerize all visible accumulations of asbestos containing material and asbestos-contaminated debris by hand. Asbestos debris mixed with soil may be picked up with shovels, with the contaminated soil being containerized as a regulated ACM waste. Clean-up activities may

also involve vacuum cleaners equipped with HEPA filtration or wet-wiping surfaces with disposable rags. Contaminated rags shall be containerized as a regulated ACM waste.

6. After disturbance and clean-up activities and prior to removal of the AC pipe from the regulated area, the Contractor shall encapsulate damaged and exposed areas and ends of the AC pipe with a lock-down encapsulant.

7. The Contractor may now remove the Category II non-friable asbestos-containing material “that is not in poor condition and is not friable” as defined in NESHAP regulations. The Contractor shall remove all AC pipe “intact” and in whole complete sections by carefully lifting the AC pipe to the disposal container using approved equipment. The Category II non-friable AC pipe must not become “friable” (crumbled, pulverized, or reduced to a powder). The Contractor shall not drop, break and/or otherwise make the AC pipe susceptible to release asbestos fibers. If these procedures are followed and debris is cleaned up properly, then the Category II non-friable AC pipe may be disposed of as nonregulated asbestos-containing waste material.

8. Pieces of AC pipe debris shall be considered RACM and handled as regulated ACM waste. The debris shall be placed in two 6-mil asbestos bags or double wrapped, with proper labeling.

J. Abandonment of AC water mains/pipes: The Contractor is responsible for isolating the existing mains to remain in service by capping, plugging and blocking as necessary. The opening of an abandoned ac water main and all other openings or holes shall be blocked off by manually forcing cement grout or concrete into and around the openings in sufficient quantity to provide a permanent watertight seal. Abandonment of old, existing AC water mains will be considered subsidiary to the work required, and no direct payment will be made.

Abandonment of Valves that contain ACM: Valves to be abandoned in the execution of the work shall have the valve box and extension packed with sand to within eight (8”) inches of the street surface. The remaining eight (8”) shall be filled with 2,500 psi concrete or an equivalent sand-cement mix and finished flush with the adjacent pavement or ground surface. The valves covers shall be salvaged and return to Public Works. The abandonment of valves containing ACM will be considered subsidiary to the work required, and no direct payment will be made.

3.07 VERIFICATION OF REMOVAL & CLEAN-UP PROCEDURES:

The Contractor's on-site Competent Person shall inspect the work area and ensure that all surfaces are free of AC pipe dust and debris.

A. Disposal Procedures

1. If a dumpster/trailer is used for temporary storage it will be secured and closed at all times except when loading. It will be properly marked and critical barrier tape will be in place.

2. AC pipe debris and asbestos-contaminated items shall be properly double bagged, labeled and loaded in a fully enclosed, lined, locked and placard transport container and transported and disposed of in compliance with all regulatory requirements as RACM.

3. After being removed from the regulated area, Category II non-friable AC pipe shall be transferred to a polyethylene-lined container. Remove all containers as soon as practical, but no later than the end of the work shift.

4. When the dumpsters/trailers are full, they will be hauled away to the closest EPA approved landfill for proper disposal. The Contractor may dispose of the Category II non-friable AC pipe waste material as non-regulated waste in a municipal solid waste landfill as defined in the NESHAP and TCEQ Rule (Type I Landfill). Written approval to transport and accept the Category II non-friable material shall be obtained from a pre-approved transporter and landfill and submitted to Public Works prior to disposal.

5. Submit copies to Public Works of all transport manifests, trip tickets, and disposal receipts for all asbestos waste materials removed from the work area during the project. The Contractor will sign manifests as the City's representative (generator) for the AC pipe and provide copies to Public Works for final payment.

END OF SECTION

SECTION 02518

STEEL PIPE AND FITTINGS FOR LARGE DIAMETER WATER LINES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Large diameter (24-In. and greater) steel pipe and fittings for water lines and pumping facilities.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for steel pipe and fittings under this Section. Include cost in unit price for water lines, pumping facilities, and encasement sleeves.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO - Standard Specifications for Highway Bridges.

B. AREMA - Manual for Railway Engineering, Volume II, Chapter 15.

C. ASTM A 36 - Standard Specification for Structural Steel.

D. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

E. ASTM A 135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.

F. ASTM A 139 - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).

G. ASTM A 570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

H. ASTM C 33 - Standard Specification for Concrete Aggregates.

I. ASTM C 35 - Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.

J. ASTM C 150 - Standard Specification for Portland Cement.

K. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

L. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

M. ASTM C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

N. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

O. ASTM D 512 - Standard Test Methods for Chloride Ion in Water.

P. ASTM D 1293 - Standard Test Methods for pH of Water.

Q. ASTM D 3363 - Standard Test Method for Film Hardness by Pencil Test.

R. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Tests.

S. ASTM D 4752 - Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub.

T. AWWA C 200 - Steel Water Pipe 6 in. and Larger.

U. AWWA C 205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe.

V. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

W. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4-In. through 144-In.

X. AWWA C 208 - Dimensions for Fabricated Steel Water Pipe Fittings; Addendum C 208A.

Y. AWWA C 209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fittings for Steel Water Pipelines.

Z. AWWA C 210 - Liquid Epoxy Coating Systems for the Interior and Exterior

of Steel Water Pipelines.

AA. AWWA C 214 - Tape Coating Systems for the Exterior of Steel Water Pipelines.

BB. AWWA C 602 - Cement-Mortar Lining of Water Pipelines – 4-In. (100 mm) and Larger – In Place.

CC. AWWA M 11 - Steel Pipe-A Guide for Design and Installation.

DD. SSPC Good Painting Practice, Volume 1.

EE. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.

FF. SSPC SP 5 - Joint Surface Preparation Standard White Blast Cleaning.

GG. SSPC SP 6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.

HH. SSPC SP 10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.

II. SSPC VIS 1 - Visual Standard for Abrasive Blast Cleaned Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings signed and sealed by Professional Engineer registered in the State of Texas showing following:

1. Manufacturer's pipe design calculations.

2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Public Works. Provide final approved lay schedule on CD-ROM in Adobe portable document format (*.PDF).

3. Include hot tapping procedure.

4. Submit certification from manufacturer that design was performed

for project in accordance with requirements of this section. Certification to be signed and sealed by professional Engineer registered in the State of Texas.

C. Submit manufacturer's certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C 200, Section 3.4.

D. Submit certification from NACE Certified Coatings Inspector, under supervision of inspector having Level III certification for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected properly repaired.

E. Submit inspection procedures to be used by manufacturer and for quality control and assurance for materials and welding. Submit at least 30 days prior to repair work, procedures that describe in details shop and field work to be preformed. Repair defects such as substandard welds, excessive radial offsets (misalignment), pitting, gouges, cracks, etc.

F. Submit following for non-shrink grout for special applications:

1. Manufacturer's technical literature including specifications for mixing, placing, and curing grout.

2. Results of tests performed by certified independent testing laboratory showing conformance to ASTM C 1107, Nonshrink Grout and requirements of this specification.

3. Certification product is suitable for use in contact with potable water.

G. Submit proof of certification for welders. Indicate certified procedures and position each welder is qualified to perform. Ensure welder and welding operator have been certified within past 6 months in accordance with AWWA C206.

H. Within 45 calendar days after manufacturing of all pipe, submit affidavit of compliance that materials and work furnished comply with applicable requirements of referenced standards and these specifications. Make available copy of physical and chemical testing reports.

I. Within 45 days of manufacturing of all pipe, submit manufacturer's affidavits that coatings and linings comply with applicable requirements of this Section and:

1. Polyurethane coatings were applied in accordance with

manufacturer's recommendation and allowed to cure at temperature 5 degrees above dew point.

2. Mortar coatings and linings were applied and allowed to cure at temperature above 32 degrees F.

3. Test Results

a. Compressive strength (7 and 28 day) test results for mortar coating.

b. Hydrostatic testing, magnetic particle and x-ray weld test reports as required

J. Prior to start of field-applied cement mortar lining operation, submit comprehensive plan which identifies and describes as minimum:

1. Equipment used for batching, weighing, mixing transporting and placing mortar.

2. Qualifications and specific experience of machine operators.

3. Source and type of cement, pozzolan, sand and admixtures used and certifications from suppliers that materials meet specifications.

4. Mix proportions to be used and slump limits (max. and min.).

5. A quality control plan which identifies quality control material tests and documented inspections necessary to ensure compliance with specified requirements.

K. Submit certification showing calibration within last 12 months for equipment such as scales, measuring devices, and calibration tools used in manufacture of pipe. Each device used in manufacture of pipe is required to have tag recording date of last calibration. Devices are subject to inspection by Public Works.

1.05 QUALITY CONTROL

A. Manufacturer to provide permanent quality control department and laboratory facility capable of performing inspections and testing as required by specifications. Material testing, inspection procedures, and manufacturing process are subject to inspection by Public Works. Perform manufacturer's tests and inspections required by referenced standards and these specifications, including the following. Correct nonconforming conditions.

1. Steel Plate and Coils: Review mill certifications for conformance to requirements of specifications; perform physical and chemical testing of each heat of steel for conformance to applicable ASTM standards.

2. Pipe:

    a. Inspect thickness, circumference, roundness, strength and size of seam welds (spiral or longitudinal), and squareness of pipe ends to verify compliance with AWWA C200.

    b. Inspect physical dimensions and overall conditions of all joints for compliance with AWWA C200, approved submittals, and Specifications.

    c. Hydrostatically test finished pipe section to 75 percent of specified minimum yield strength of steel being used with zero leakage.

    d. For wall thickness greater than 1/2-In. perform Charpy V-Notch (CVN) Test in accordance with AWWA C200.

3. Linings:

    a. Inspect unlined pipe for overall condition of inside barrel. Maintain inside barrel free of corrosive products, oil, grease, dirt, chemical, and deleterious material.

    b. Inspect lined pipe for physical dimensions and overall condition of lining, visible surface defects, thickness of lining, and adhesion to steel surface.

    c. Review certifications by manufacturers of lining components for conformance to AWWA standards and these Specifications.

4. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.

5. Final Inspection:

    a. Before shipment, inspect finished pipe, fittings, specials and accessories for markings, metal, coating thickness, lining

thickness (if shop applied), joint dimensions, and roundness.

b. Inspect for coating placement and defects. Test exterior coating for holidays.

c. Inspect linings for thickness, pitting, scarring, and adhesion.

B. Shop-applied coatings and linings; provide services of independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Perform inspection by NACE trained inspectors under supervision of NACE Level III Certified Coatings Inspector.

C. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.

D. Cast four standard test cylinders each day for each 50-cubic yards of mortar coating or portion thereof for each coating and lining placed in a day. Perform compressive strength test at 28 days. No cylinder test result will be less than 80 percent of specified strength.

E. Dented steel cylinders will result in rejection of pipe.

F. Make available copy of physical and chemical testing reports for steel cylinders and provide reports at request of Public Works.

G. Check physical dimensions of pipe and fittings. Physical dimensions to include at least pipe lengths, pipe I.D., pipe O.D. and bend angles.

1.06 INSPECTION

A. Public Works may witness manufacture and fabrication of pipe and appurtenances. Independent testing laboratory under contract to Public Works may perform tests at direction of Public Works to verify compliance with these specifications. Provide assistance to accomplish such testing, including equipment and personnel, at no additional cost to the City.

PART 2 PRODUCTS

2.01 STEEL PIPE

A. Furnish pipe by same manufacturer.

B. Furnish pipe smaller than 24-In. in accordance with Section 02502 – Steel Pipe and Fittings.

C. Fabricate and supply miscellaneous steel pipe and fittings with nominal

diameter of 24-In. and larger in accordance with AWWA C200, C207, C208 and AWWA M11 except as modified herein. Steel to be minimum of ASTM A 36, ASTM A 570 Grade 36, ASTM A 53 Grade B, ASTM A 135 Grade B, or ASTM A 139 Grade B.

D. Provide pipe sections in lengths no greater than 40-Ft. and no less than 10-Ft. except as required for special fittings or closure sections.

E. Provide shop-coated and shop-lined steel pipe with minimum of one coat of shop-applied primer approved for use in potable water transmission on all exposed steel surfaces. Primer for tape-coated steel pipe to be used for field-applied coatings shall have no less than 5 percent solids. Provide primer compatible with coating system and in accordance with coating manufacturer's recommendations.

F. Provide closure sections and short sections of steel pipe not less than 4-Ft. in length unless indicated on Drawings or specifically permitted by Public Works.

G. Square flanges with pipe with bolt holes straddling both horizontal and vertical axis. Provide 1/2 –In. gap between pipe ends to be coupled with sleeve coupling unless otherwise indicated on Drawings

1. Provide standard ring or hub type flanges, conforming to AWWA C207, Class D.

2. Apply Densco petroleum-based tape or approved equal to exposed portions of nuts and bolts.

H. Pipe Design Conditions:

1. Design: Design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading, AREMA E-80 loads and depths of bury as indicated on Drawings. Design pipes with Marston's earth loads for transition width trench for all heights of cover.

2. Groundwater Level: Design for most critical ground water level condition,

3. Working pressure = 100 psi.

4. Hydrostatic field test pressure = 150 psi.

5. Maximum pressure due to surge = 150 psi.

6. Minimum pressure due to surge = -5 psi.

7. Modulus of elasticity (E) = 30,000,000 psi.

8. Maximum deflection from specified diameter: Two percent for mortar coating; three percent for flexible coatings and three percent for mortar lining.

9. Design stress due to working pressure to be no greater than 50 percent of minimum yield, and stress not to exceed 16,500 psi for mortar coated pipe.

10. Design stress due to maximum hydraulic surge pressure to be no greater than 75 percent of minimum yield, and stress not to exceed 24,750 psi for mortar coated pipe.

11. Modulus of soil reaction (E_N) < 1500 psi. If E_N > 1000 psi, do not use silty sand (SM) for embedment.

12. Unit weight of fill (w) > 120 pcf.

13. Deflection lag factor (D1) = 1.2.

14. Bedding constant (K) = 0.1.

15. Fully saturated soil conditions: hw = h = depth of cover above top of pipe.

16. Do not allow diameter (D) over thickness (t) ratio to be greater than 230.

17. Provide minimum inside clear diameter for tunnel liners or casing in accordance with Section 02425LD- Tunnel Excavation and Primary Liner.

18. Exclude structural benefits associated with primary liner in design of pipe in tunnel installations.

    a. Design pipe and joints to carry loads including overburden and lateral earth pressures, subsurface soil and water loads, grouting, other conditions of service, thrust of jacks, and stresses anticipated during handling and construction loads during installation of pipe.

    b. Do not use internal removable stiffeners for pipe in tunnel,

unless approved by Public Works.

c. External welded steel stiffeners will be permitted in design calculations for steel pipe, provided wall thickness is minimum of ½-In. Minimum clearances specified between exterior pipe wall and tunnel liner applies to distance between outside diameter of external welded stiffener and tunnel liner.

19. Nominal Allowable Steel-wall Thickness for Water Lines: Provide in accordance with following table for HS-20 live loads and depths of cover of up to 16-Ft. Net internal diameter (including inside linings) to be no less than net inside diameter listed. Contractor to review design for conditions more extreme than those indicated by this specification and design accordingly. If, in opinion of Public Works, proposed pipe wall thicknesses appear inadequate for indicated loading conditions, submittal of design calculations will be required for review. Pipe wall not to be less than that defined in following table.

Net Inside Dia. (Inches)	**Minimum Wall Thickness (Inches)**	
	Flexible Coating	Mortar Coating
96	0.484	0.464
90	0.454	0.430
84	0.423	0.395
78	0.393	0.359
72	0.362	0.320
66	0.333	0.295
60	0.301	0.268
54	0.271	0.250
48	0.235	0.215
42	0.207	0.189
36	0.178	0.163
30	0.149	0.136
24	0.149	0.136

I. Fittings for Water Lines: Fabricate in accordance with AWWA M11, Section 13.3-13.7, and AWWA C208.

1. Wall Thickness: Equal to or greater than pipe to which fitting is to be welded.

2. Elbows: 2-piece for 0 degrees to 22-1/2 degrees; 3-piece for 23 degrees to 45 degrees; 4-piece for 46 degrees to 67-1/2 degrees; and 5-piece for 68 degrees to 90 degrees, unless otherwise shown on Drawings.

3. Outlets: Reinforced in accordance with AWWA M11, Sections 13.3-13.7, AWWA C200, and AWWA C208. Provide interior lining and exterior coating in accordance with paragraphs on coating and lining and matching pipe to access inlets, service outlets, test inlets, and air-vacuum valve and other outlets, including riser pipes.

4. Radius: Minimum radius of two and one-half times pipe diameter.

5. Butt Straps for Closure Piece: Minimum 12-In.wide split butt strap; minimum plate thickness equal to thinnest member being joined; fabricated from material equal in chemical and physical properties to thinnest member being joined. Provide minimum lap of 4-In. between member being joined and edge of butt strap, welded on both inside and outside, unless otherwise approved by Public Works. Provide minimum 6-In. welded outlet for inspecting each closure section, unless access manway is within 40-Ft. of closure section.

6. Joints are to be double-welded and butt or lap joints as shown on drawings. Use flanged joints at valves.

7. Provide double-welded lap field joints or full penetration butt-welded joints for tee fitting supported on pier foundation, aboveground piping and field welds for risers including vertical portion of crossover piping.

J. Joints:

1. Standard field joint for steel pipe: AWWA C206. Rubber gasket Carnegie shape joint or rolled-groove rubber gasket and O-ring joint, 66-In. maximum diameter. Joints may be lap-welded slip type in accordance with AWWA C206, except where flanged joints or butt strap joints are required.

2. Provide double-welded butt joints at aerial crossings and where noted on Drawings.

3. Pipe Manufacturer: Minimum of 5 years of successful service with proposed field joint or submit results from joint tests determined by Public Works. Tests which may be required include tensile strength or yield tests of base material and spiral welded sections (API 5L), flattening tests, chemical analysis, impact and hardness tests. Public Work's decision as to acceptability of joint is final.

4. Capable of withstanding jacking forces.

5. Design restrained joints for test pressure or maximum surge pressure as specified, whichever is greater.

6. Provide full circumferential welds at joints required to be welded.

7. Use wire and flux from same manufacturer throughout entire project.

8. Rubber Gasketed Bell-and-Spigot Joints.

   a. Bells: Formed by either expansion of pipe end, or by segmental expander which stretches steel past its elastic limit, or by attaching sized weld-on bell rings. Spigot ends: Sized prior to rolling gasket groove. Joints: Interchange- able and match up during installation, even if used out of sequence. Weld-on bell rings: AWWA M11; AWWA C200; attached with single or double, full thickness fillet welds (double weld in areas of thrust restraint).

   b. Provide bells and spigots with dimensions and tolerances in accordance with AWWA C200, as modified herein. Difference in diameter between I.D. of bell and O.D. of spigot shoulder at point of full engagement with allowable deflection range of 0.00-In. to 0.04-In. as measured on circumference with diameter tape. Minimum thickness of completed bell ring is equal to thickness of pipe wall in barrel of pipe between joint ends.

   c. Furnish joint suitable for safe working pressure equal to class of pipe and will operate satisfactorily with deflection, tangent of which is not to exceed 0.75-In./D where D is outside diameter of pipe in inches or with pull-out of 3/4–In..

   d. Design clearance between bells and gasketed spigots so, when joint is assembled, it will be self-centered and gasket will be restrained or confined to annular space in such manner that movement of pipe or hydrostatic pressure cannot displace it. Compression of gasket when joint is completed will not be dependent upon water pressure in pipe and will provide watertight joints under operating conditions when properly installed.

K. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

Line Diameter	Required Bends*
20 and 24-In.	Four 45 degree bends per 5,000 LF of water line
> 24-In.	Four 22.5 degree bends per 10,000 LF of water line

*Based on total length of contract (minimum of four). Any combination of bends may be substituted at manufacturer's option (i.e. two 22.5 degree bends are equivalent to one 45 degree bend) and will be counted as one fitting.

L. Manufacturer must be capable of delivering bends to job site within 12 hours of notification. Use fittings at direction of Public Works where unforeseen obstacles are encountered during construction. These fittings are in addition to fittings called out on Drawings and must be available at all times. Use same product throughout entire project.

M. Perform x-ray or ultrasonic testing of manual welds on special pipe and fittings.

N. Hydrostatic Test of Pipe:

1. AWWA C200, Section 3.5.3, at point of manufacture. Hold test for minimum 2 minutes and conduct thorough inspection of pipe. Repair or reject pipe revealing leaks or cracks.

2. Calibrate pressure gauges within one year prior to testing as specified in Section 1.04 L.

O. Provide forged steel threaded outlets of approved design where required for use in passing hose or lead wires into pipe. Tap plugs with standard pipe threads and weld to pipe in approved manner and use solid forged steel plugs for closure.

P. Flanges:

1. Fabricate flanges with oversize bolt holes, with flanges drilled in pairs, to accommodate insulating sleeves.

2. Test, coat, line and ship each shop-assembled insulated flange assembly to field as fitting. Use no less than two snug-fitting alignment pins to assist in aligning flanges during assembly. Do not remove pins until bolts have been installed in all remaining holes and have been drawn up tight. After insulating joints have been assembled, subject each assembly (fitting) to shop hydrostatic test pressure of 150 psi and electrically test to ensure that insulated sections are effective. After assembly has been tested, coat insulating joint and adjacent steel pipe as specified for below-ground installation. Line assembly as specified for interior surfaces and in accordance with details shown on Drawings.

Q. Dished Head Plugs: Design dished head plugs (test plugs) to withstand field hydrostatic test pressure from either side of plug. Design stress due to hydrostatic pressure to be no greater than 50 percent of minimum yield. Pipe on opposite side of hydrostatic test may or may not contain water. Manufacturer of the steel pipe to hydrostatically test plug at factory.

R. Make curves and bends by deflecting joints, or by using beveled joints, or by combination of two methods, unless otherwise indicated on Drawings or permitted by Public Works. Do not exceed deflection angle at joint as recommended by pipe manufacturer. Make penetration of spigot into bell at all points of circumference at least equal to minimum required penetration shown on Drawings. Beveled pipe sections used in curved alignment to be of standard length except when shorter sections are required to limit radius of curvature, in which case all sections throughout curve are to be of equal length. Do not allow bevel to exceed 5 degrees.

2.02 INTERNAL LINING SYSTEMS FOR STEEL PIPE, ALL INSTALLATIONS

A. Supply steel pipe with either epoxy lining or cement-mortar lining, capable of conveying water at temperatures not greater than 140 degrees F. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61, and certification to be from organization accredited by ANSI. Unless otherwise noted, coat all exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, with epoxy lining, as specified.

B. Epoxy Lining:

1. AWWA C210, color White, or approved equal for shop and field joint applied, except as modified in this Section. Provide materials from same manufacturer.

a. Protect interior surface with approved liquid two-part chemically cured epoxy primer specified for interior surfaces.

Surface Preparation	SSPC – SP5 White Blast Clean 2.0 to 3.0 mils surface profile
Prime Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy – Buff, or Approved equal
Intermediate Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy – Buff, or Approved equal
Finish Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy – White, or Approved equal

2. Total allowable dry film thickness for system:

   a. Minimum: 12.0-Mils.

   b. Maximum: 18.0-Mils.

3. Provide dry film thicknesses for approved alternate products in accordance with product's manufacturer recommendations.

4. Lining system may consist of three or more coats of same approved alternate epoxy lining without use of separate primer.

5. Perform adhesion test on pipe 48-In. in diameter and larger in accordance with ASTM D 4541. Minimum field adhesion: 700 psi. Perform test on pipe for project at frequency of one for every 1000 square feet of epoxy lining. Perform cure test in accordance with ASTM D 4752 (solvent rub test) and ASTM D 3363 (pencil hardness) for each section of pipe. Repair tested areas with approved procedures.

C. Shop-applied Cement-mortar Lining:

1. AWWA C205; except as specified herein: 1/2-In. minimum thickness for pipe diameters 42-In. and larger; 3/8-In. minimum thickness for pipe diameters 36-In. and smaller. Cut back lining from joint ends no more than 2-In. to facilitate joining and welding of pipe.

2. Apply cement-mortar lining to inside of pipe by centrifugally spinning. For special sections (shape of which precludes application by spinning method) accomplish by mechanical placement or pneumatic placement and finish to produce smooth, dense surface comparable to centrifugally spinning.

3. Use galvanized wire mesh when shop-applied mortar is not applied

by machine. Do not extend wire mesh across welded portion of mitered fittings. Crimp mesh to provide integral "chair" so wire does not fully rest against steel cylinder.

4. Make repairs of cement-mortar lining for widths exceeding 6-In. by bonding to steel and adjacent faces of lining with bonding agent conforming to ASTM C 881, Type II.

5. Restrict usage of sprinkler heads during moist curing to prevent over spraying onto lining. No alternative curing methods are allowed as described in Section 4.4.7.4 of AWWA C205.

6. Satisfy Public Works that above requirements can be accomplished by manufacturer prior to shipment of pipe.

D. Field-applied Cement-mortar Lining (for pipe $\geq$ 48-In. in diameter): Provide field-applied internal cement-mortar linings in accordance with AWWA C602, latest edition, except as modified in this Section.

1. Lining: Applied in one-course application of cement-mortar by machine that centrifugally places mortar against wall of pipe and mechanically trowel lining to smooth finish.

2. Steel pipe, fittings, receives cement-mortar lining.

3. Cement-mortar for lining.

a. Cement-mortar: Dense, smooth, and of uniform quality and consistency to assure efficient machine operation and uniform cement-mortar lining on pipe wall.

b. Water-cement ratio: Kept as low as possible; consistent with proper plasticity for application, allowing slight variations dependent upon temperature, length of haul for mortar, and moisture condition in pipe.

c. Mortar: Mixture of one part cement with not less than one or more than 1-1/2 parts of dry screened sand, by volume. After determining mixture, control materials to within plus or minus 2-1/2 percent by weight throughout entire work.

d. Comply with following materials for cement-mortar:

1) Provide Type II low-alkali Portland cement conforming to ASTM C 150, or Type IP (MS) Portland-Pozzolan cement conforming to ASTM C 595, unless otherwise

specified. Conform to low alkali requirements of Table IA of ASTM C 150. Type IP (MS) cement to contain no more than 20 percent Pozzolan, to be inter-ground with clinker.

2) Use suitable facilities approved by Public Works when available for handling and weighing bulk cement. Otherwise, deliver cement in original unopened sacks that have been filled by manufacturer. Plainly mark sacks with manufacturer's name or brand, cement type lot number and weight. Discard unused cement. Use unopened bags of cement for each new batch.

3) Material storage: Store cement to permit ready access for inspection and sampling. Protect cement and sand against contamination or moisture. Do not use and remove from site cement delivered with evidence of contamination or otherwise unsuitable. Store admixtures in accordance with manufacturer's directions.

4) Use Portland cement of same brand and type unless otherwise approved by Public Works.

5) Pozzolanic material: AWWA C602, Paragraph 2.2.

6) Sand: AWWA C205, Section 2.3, except gradation of sand to yield fineness modulus of approximately 1.7; having no material coarser than that passing No. 16 sieve. Submit certification for compliance of sand with these specifications at least 10 calendar days before start of lining placement.

7) Water: Clean; free of deleterious amounts of acids, alkalis or organic materials; total dissolved solids less than 1000 mg/l; ASTM D 512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D 1293 pH greater than 6.5.

2.03 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVEGROUND AND IN VAULTS (EXPOSED)

A Provide external coating system as designated in Section 09905 CLEANING AND PAINTING EXPOSED PIPING, VALVES AND RELATED ITEMS.

2.04 EXTERNAL COATING SYSTEMS FOR BURIED STEEL PIPE

A. Supply pipe with one of the following coatings specified.

1. Tape Coating: Provide approved tape for external tape coating. Apply in accordance with AWWA C214 and requirements of this section; 80-Mil.

a. Components: Primer, one 20-Mil layer of inner-layer tape for corrosion protection and two 30-Mil layers of outer-layer tape for mechanical protection.

b. Where sleeve type or victaulic couplings are required, bond coupling to adjacent pipes with bonding cables as shown on Drawings.

c. Use approved filler putty type insulating putty to fill in gap and create smooth sloped transition between top of reinforcing plate and pipe, before tape coating is applied.

d. Primer: Compatible with tape coating, supplied by coating-system manufacturer.

e. Provide pipe with shop coatings cut back approximately 4 to 4 1/2-In. from joint ends to facilitate joining and welding of pipe. Taper successive tape layers by 1-In. staggers to facilitate field wrapping and welding of joints.

f. Inner and outer tape width: 12 or 18-In.

g. Do not expose tape coating to direct sunlight for more than 60 days.

2. Cement-mortar Coating: AWWA C205; shop-applied, cement-mortar coating except as modified in this Section; 1-In. minimum thickness; cut back coating from joint ends no more than 2-In. to facilitate joining and welding of pipe.

3. Polyurethane Coating: See Section 02527 - Polyurethane Coatings on Steel or Ductile Iron Pipe for requirements for use of polyurethane coating system.

B. Heat Shrink Joint Sleeves for Tape and Polyethane Coating: Aqua-shield, or approved equal. For repairs to heat shrink joint sleeves, use Aqua-shield Repair Patch Kit or approved equal.

2.05 EXTERNAL COATING SYSTEM FOR STEEL PIPE IN TUNNEL, CASING

A. Provide exterior coating system of pipe in tunnel, without annular grout, as specified in Cement Mortar Coating for Buried Steel Pipe, or provide minimum 80-Mils of polyurethane coating in accordance with Specification Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.

B. For water lines in tunnel where annular grout will be used, shop prime external surfaces of steel pipe with 4.0 to 6.0-Mils DFT of approved Inhibited Epoxy Primer unless pipe has cement-mortar coating.

1. Surface Preparation: SSPC-SP 10(64); Near White Blast Clean 2.0 to 3.0-Mils surface profile.

2. Prime Coat: Approved Inhibitive Epoxy Primer 4.0 to 6.0-Mils DFT.

3. Use coating procedures and dry film thicknesses for approved alternate product in accordance with product manufacturer's recommendations.

2.06 GROUT FOR JOINTS AND SPECIAL APPLICATIONS

A. Cement Grout Mixture: One part cement to two parts of fine, sharp clean sand. Mix interior joint mortar with as little water as possible until very stiff but workable. Mix exterior joint mortar with water until it has consistency of thick cream. Mix cement grout to specific gravity of 19-Lb/gallon or greater as measured by grout/slurry balance. Use balance manufactured grout/slurry by Baroid or approved equal. Perform test in presence of and at request of Public Works. Add additional cement grout or water to mixed cement grout to bring mix to proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.

1. Portland Cement: ASTM C 150, Type II. Provide one type of cement for entire project.

2. Sand:

a. Interior joints: ASTM C 35 fine graded plaster sand.

b. Exterior joints: ASTM C 33; natural sand with 100 percent passing No. 16 sieve.

3. Water: Potable water with total dissolved solids less than 1000 mg/l; ASTM D 512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D 1293 pH greater than 6.5. Use potable water

with 250 ppm limit on chlorides and sulfates.

B. Provide approved Nonshrink Grout for Special Applications, Patches and Repairs.

1. Conform to requirements of ASTM C 1107, Nonshrink Grout.

2. Pre-blended factory-packaged material manufactured under rigid quality control, suitable for use in joints of prestressed concrete cylinder pipe.

3. Contain non-metallic natural aggregate and be nonstaining and noncorrosive.

4. Meeting NSF 61 Standard suitable for use in contact with potable water supply.

5. Exterior: Highly flowable to fill joint wrapper without leaving voids or trapped air. Interior capable of being placed with plastic consistency.

6. Compressive strength: ASTM C 1107 2500 psi minimum 7-day unconfined; 5000 psi minimum 28-day unconfined.

7. Non-bleeding and non-segregating at fluid consistency.

8. Contain no chlorides or additives which may contribute to corrosion of steel pipe.

9. Free of gas-producing, gas-releasing agents.

10. Resist attack by oil or water.

11. Mix, place, and cure in accordance with manufacturer's instructions and recommendations. Upon 72 hours' notice, provide services of qualified representative of nonshrink grout manufacturer to aid in assuring proper use of product under job conditions. Representative to be on site when product is first used.

12. Mix cement grout to specific gravity of 17.7-Lb/gallon or greater as measured by grout/slurry balance. Use balance manufactured grout/slurry by Baroid or approved equal. Perform test in presence of and at request of Public Works. Add additional cement grout to mixed cement grout or water to bring mix to proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or

moisture content.

13. Compressive strength: ASTM C 1107 2500 psi minimum 7-day unconfined; 5000 psi minimum 28-day unconfined.

C. Finished surface of lining and interior joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat and uniform-appearing finish.

D. Joint Wrapper: Minimum width of 9-In. for 33-In. diameter and smaller; minimum width of 12-In. for diameters greater than 33-In. hemmed at edge to allow threading with minimum 5/8-In. wide steel strap. Provide minimum 6-In. wide Ethafoam strip sized, positioned, and sewn such that two circumferential edges of Ethafoam are 1 1/2-In. from outer edge of wrapper.

2.07 COLD-APPLIED TAPE COATING

A. Shop-applied Tape Wrap Coating

1. Use primer furnished by tape manufacturer.

2. Wrap, specials and fittings that cannot be machine wrapped due to configuration with primer layer and two layers of prefabricated tape each 35-Mils thick.

3. Overlap machine applied tape with hand applied tape by minimum of 2-In. and bind to it.

4. Apply approved 30-Mil filler tape parallel to spiral weld seams if weld height measures greater than or equal to 1/8-In..

B. Surface Preparation

1. Clean bare pipe from mud, mill lacquer, oil, grease, or other contaminants. Inspect and clean surfaces according to SSPC-SP-1 to remove oil, grease, and loosely adhering deposits prior to blast cleaning. Remove visible oil and grease spots by solvent wiping. Use approved safety solvents which do not leave residue. Preheating to remove oil, grease, mill scale, water, and ice may be used provided pipe is preheated in uniform manner to avoid distortion.

2. Remove surface imperfections such as slivers, scabs, burrs, weld

spatter, and gouges by hand filling or grinding to prevent excessive number of holidays. Presence of metallic defects may be cause for rejection of pipe.

2.08 EXTERNAL TAPE COATING SHOP APPLICATION

A. Separate tape dispensing equipment far enough apart to visually inspect continuous steps.

B. Make cutbacks straight and for total thickness of coating.

C. State of dryness of primer prior to application of weld filler and inner layer of tape to be in accordance with written recommendation of manufacturer.

D. Apply weld filler tape over primer and extend minimum of one inch on each side of weld seam. Filler tape may contact rollers as long as release liner is in place and adhesion requirements are met. Remove release liner before applying inner layer tape.

E. Spirally apply inner layer of tape in direction of helix weld. Overlap each spiral of tape1-In. or greater with next successive spiral of tape applied.

F. Overlap end of new roll on top of previous roll minimum of 6-In.

G. Tape-roll body temperature to be greater than 70 degrees F; pipe surface temperature to be greater than 60 degrees F.

H. Spirally apply outer layer tapes in direction of helix weld and use overlap width and application tensions as recommended by manufacturer.

2.09 INSPECTION AND TESTING OF COATINGS

A. Perform electrical inspection on inner layer of tape before intermediate layer of tape is applied.

B. If holidays are detected, repair holidays immediately before applying outer layer of tape. Clear holiday area of material and re-prime if necessary. Recoat area with inner wrap tape. Overlap inner wrap tape onto surrounding inner wrap coating by at least 2-In. Perform electrical retest at repaired area after repairing holiday, and before outer wrap is continued.

C. Shrink Wrap: Perform electrical inspection on shrink wrap to check for holidays. Perform peel tests over heat affected zone. Minimum acceptable result: 15-Lbs-Ft/In.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Conform to applicable provisions of Section 02511 - Water Lines, except as modified in this Section.

B. Comply with following:

1. Make available services of manufacturer's representative when deemed necessary by Public Works. Representative to advise in aspects of installation, including but not limited to handling and storing, cleaning and inspecting, coating and lining repair, and general construction methods as applicable to pipe.

2. Install stulls prior to placement of pipe, bends, and fittings to prevent deflection during installation. Provide stulls consisting of timber struts with end blocks shaped to fit curvature of interior surface of pipe or other appropriate configuration and material. Firmly edge and secure stulls to blocks so that they will remain intact position during handling and installation. Provide stulls adequate to resist loads encountered without structural failure to stull members or damage to pipe. Where applicable, place stulls at such lengths so as to elongate vertical diameter of pipe as required to suit trench conditions encountered.

3. Handling and Storage: Install padded struts or stulls prior to shipping, horizontally and vertically at 10-Ft. intervals, or as proposed by manufacturer and approved by Public Works. Spiders: Installed in joint ends of fittings. Stulls to remain in place, horizontally and vertically positioned under following conditions:

a. During storage and shipping.

b. Until welding is complete.

4. Reject and remove immediately from site pipe that arrives at site with defects in lining, including sand pockets, voids, and oversanded areas.

5. Store pipe at job site with securely fastened plastic endcaps to maintain moist pipe interior. Promptly replace damaged endcaps to avoid shrinkage or cracking of cement-mortar lining.

6. Immediately replace damaged plastic end caps. Do not leave uncapped for more than 4 hours.

7. Bedding and Backfilling:

   a. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

   b. Align pipe at proper grade prior to joint connection and do not shift after jointing operation has been completed.

   c. Take necessary precautions during bedding and backfilling operations to prevent deformation or deflection of cylindrical shape of pipe by more than allowable pipe deflection. Do not move trench support system (trench safety system) once bedding material is compacted.

   d. Excavate outside specified trench section for bell holes, and for spaces sufficient to permit removal of slings. Provide bell holes at proper locations for unrestricted access to joint. Form bell holes large enough to facilitate joint wrapping and to permit visual examination of process. Enlargement of bell holes as required or directed by Public Works. Subsequent backfilling thereof will not be considered as authorized additional excavation and backfill. Backfill bell holes and spaces to satisfaction of Public Works.

   e. Blocking may be removed 24 hours after placing backfill to top of pavement or natural ground level.

8. Pipe Deflection: After backfill is complete, test pipe for excessive deflection by measuring actual inside vertical diameter. For maximum deflection allowable, see Section 2.01.

   a. Deflection may be measured by Public Works at location along pipe. Arithmetical averages of deflection are not acceptable.

   b. If deflection exceeds that specified, do one of the following:

      1) Remove backfill and side support. Reround the pipe and properly replace compacted backfill and side support. Review cement mortar lining to assure that no harmful damage has occurred.

      2) Remove entire portion of deflected pipe section and install new pipe as directed by Public Works at no

additional cost to the City.

9. Move pipe in such a manner not to damage pipe or coating. Do not roll pipe nor drag on ground. Inspect and repair coating abrasions before pipe is lowered into trench.

10. Use of dogs, clips, lugs, or equivalent devices welded to steel pipe for purpose of forcing it into position will not be permitted unless approved by Public Works. Remove foreign matter and protective material from surfaces that are to be in contact at joints. Leave surfaces of joint areas thoroughly clean for metal-to-metal contact of field joints.

C. Static Electricity:

1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.

2. Electrically test where required after installation of pipeline is complete.

D. Deviation of installed pipe in one pipe section from line and grade shown on approved shop drawing layout will not exceed 2-In. from grade and 3-In. from line. No deviation from line and grade at contact interfaces are allowed.

E. Use adequate surveying methods, procedures and employ competent surveying personnel to ensure pipe sections are laid to line and grade and within stipulated tolerances. Measure and record, in form approved by Public Works and submit copy of data to Public Works at end of that day. Survey data to include unique pipe number, deflection angle at pipe joint and whether beveled ends were used, invert elevation at pipe joint, deviation of joint from project line, deviation of joint from project grade, inside pipe joint lap measured at top, bottom, and at springline (each side).

F. Any time that laying of additional pipe is stopped for more than eight hours; plug ends of installed pipe and take proper precautions against flotation of pipe segments.

3.02 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVE GROUND AND IN VAULTS (EXPOSED) AND EPOXY INTERNAL LINING SYSTEM

A. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective

equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.

B. Workmanship:

1. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.

2. Paint Application Procedures: SSPC Good Painting Practices, Volume 1.

C. Surface Preparation:

1. Use abrasive blasting to prepare surfaces.

2. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly-painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.

3. Prior to blasting, clean surfaces to be coated or lined of grease, oil and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.

4. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux and spatter by grinding to ¼ inch minimum radius.

5. Abrasive Material:

a. Blast only as much steel as can be coated within same day of blasting.

b. Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to jobsite in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.

c. After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Tex Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to Public Works.

d. Do not blast if metal surface may become wet before priming commences, or when metal surface is less than 5 degrees F

above dew point.

6. Evaluate degree of cleanliness for surface preparation with use of SSPC Pictorial Surface Preparation Standards for Painting Steel Surfaces, SSPC-Vis 1.

7. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing 3/4-In. by 4-In. piece of clear Scotch-type tape on blasted surface, then removing and placing tape on 3x5 white index card. Reclean areas exhibiting dust or residue.

D. Coating and Lining Application:

1. Environmental Conditions: Do not apply when metal temperature is less than 50 degrees F; when ambient temperature is less than 5 degrees F above dew point; when expected weather conditions are such that ambient temperature will drop below 40 degrees F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper humidity levels.

2. Application Procedures:

a. Apply in accordance with manufacturer's recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive over spray, or delaminations.

b. Thin materials only with manufacturer's recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.

c. Discard catalyzed materials remaining at end of day.

3. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.

4. Cure minimum of 24 hours at 77 degrees F before successive coats are applied. During curing process, provide force air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats

within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coats are applied, provide forced-air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.

3.03 EXTERNAL COATING SYSTEM FOR BURIED STEEL PIPE

A. Tape Coating System:

1. Joint Protection

a. Coating field joints, tie-ins, and other field-welded joints: Provide application of approved insulating putty at bell step-offs, and two wraps of Field Joint Tape Primer: Furnished by tape manufacturer.

b. At Contractor's option, apply approved special heat resistant tape system prior to internal welding of pipe. Coat entire pipe with shop-applied tape. Coat bell end with shop-applied heat-resistant tape. In field, fill joint step off area with insulating putty. Field apply two layers of field joint tape over joint followed by high shear strength outerwrap. Follow manufacturer's recommendation for field-applied tape coating.

c. At Contractor's option, provide field-applied shrink-wrap coating system for coating field joints, tie-ins and other field welded joints. Apply heat-shrink sleeves prior to internal welding of pipe using approved procedure compatible with coating system. Install heat-shrink joint sleeves in accordance with manufacturer's recommendations. Provide shrink-wrap systems consisting of primer, tape coating and polyurethane coating and high-strength application of Aqua-shield Wrap for pipeline. Provide services of technical representative of manufacturer available on site at beginning of pipelaying operations. Representative to advise Contractor and Public Works regarding installation, repairs, and general construction methods.

2. Field Application: AWWA C209 around joint cutbacks except as modified:

a. Field-welded joints: Clean shop-primed ends of weld

splatter, damaged primer, and rust to achieve required surface preparation prior to field repair of coatings.

b. Extend joint cleaning 4 inches onto existing coating. Completely remove damaged and loose end-coatings.

c. Prior to placing pipe in trench, remove shop-applied primer by abrasive blasting, solvent or other method as approved by Public Works. Avoid damage to adjacent existing coatings.

d. Clean surfaces to achieve surface preparation at least equivalent to SSPC SP 6 in accordance with AWWA C209. Provide solvent that is environmentally safe and compatible with coating system primer.

e. Apply insulating putty onto bell step-off as shown on Drawings. Remove release liner during application.

f. Apply primer immediately prior to application of first layer of tape to achieve maximum bond. Apply tape while primer is still "tacky" with 3-In. minimum overlap over shop-applied coating.

3. Joint Tape

a. Extend inner wrap minimum of 2-In. onto existing coating on each side of joint. Extend outer wrap minimum of 4-In. onto existing coating each side of joint. Stagger end laps minimum of 6-In. Overlap adjacent tape wraps at least 1-In., and overlap seam of outer wrap. Do not allow to be coincident with overlap seam of inner wrap. Wash with Xylol area that will be overlapped.

b. Apply approved joint wrap tape to uncontaminated primer at proper roll body temperature. If necessary, store joint wrap material in heated box up to point of application.

c. Apply joint wrap material to pipe in either spiral or cigarette fashion dependent upon specification. Begin wrapping process 2 to 4-In. onto mill-applied pipe wrap and proceed wrinkle-free up over bell and across joint to spigot side pipe wrap.

d. Apply joint wrap under machine tension of 5 to 10-Lb./In. width. Joint wrap width should narrow (neck down) as

material is applied tightly around pipe.

e. Apply first 1/3 and last 1/3 turn of joint material around pipe with less tension to prevent wrap crawlback. Overlap of joint wrap material and system's total thickness as specified in this specification section.

f. End joint wrap process such that its final edge is directed downwards when pipe is placed in ditch to prevent backfill from pulling exposed joint wrap edge.

4. Do not expose tape coatings or heat-shrinkable joint sleeves to harmful ultraviolet light for more than 90 days. Discard (remove) and replace outer layer of tape coating when exposure exceeds 90 days. In case of factory-applied coatings, remove pipe from site for removal and reapplication of outer layer of tape coatings.

5. At option of Public Works, coating system and application may be tested and inspected at plant site in accordance with AWWA C214.

B. Test for holidays:

1. Inspect pipe for holidays and damage to coating.

a. If test indicates no holidays and outer wrap is torn, remove damaged layers of outer wrap by carefully cutting with sharp razor-type knife. Wash with Xylol area to be patched and at least 4-In. of undamaged tape where hand-applied tape wrap will overlap. AWWA C209 cold-applied tape compatible with tape- wrapping system applied for each layer of outer-wrap tape that has been removed.

b. If test indicates holiday, remove outer layers and expose inner wrap. Prime exposed area and overlaps with light coat of primer. Firmly press into place patch of two 35-Mil inner wrap tape extending 4-In. from affected area in all directions. Second patch to overlap first patch by 2-In. Perform holiday test of patch to verify satisfactory installation. Wash exposed outer wrap tape with Xylol and prime.

c. For severe outer wrap tape tears or damage, and holiday is not detected, remove outer wrap to boundaries of damaged area, taking care not to damage inner wrap coating. Before replacing outer wrap, apply holiday detector to exposed area to determine that no damage has been made to primary coating. After verification that no holidays exist in underlying

tape, clean damaged area and use patch of 35-Mil outer wrap tape. Apply as specified herein for repair of areas where bare pipe is exposed.

2. Do not allow bubbles in tape coating system regardless of holiday test results, cut out bubbles and patch as described above as directed by Public Works.

3. Perform test procedure in accordance with NACE Standard RP-02-74. Perform electrical holiday test with 60-cycle current audio detector. Use test voltage below:

Total Coating Thickness (Mils)	Test Voltage (Volts)
20	6,000
30/35	7,500
50	9,000
70	11,500
80	12,000

C. Remove areas having physical damage and recoat. After repairing area, apply holiday detector as stated above to verify area is adequately repaired.

D. Cement mortar coating. AWWA C 205; 1-In. minimum thickness; Cut back from joint ends no more than 2-In. to facilitate joining and welding of pipe.

3.04 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints.

1. Use O-ring gasket with sufficient volume to approximately fill area of groove and gasket material in accordance with AWWA C200. Check each splice in gasket by stretching gasket to at least twice original length of gasket. Visually check stretched splice by rotating 360 degrees. Reject splices showing visible separation or cracks.

2. Equalize rubber gasket cross section after rubber gasket is placed in spigot groove of pipe by inserting tool or bar such as large screwdriver under rubber gasket and moving it around periphery of pipe spigot. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined. Fit pipes together in manner to avoid twisting or otherwise displacing or damaging rubber gasket. Check gaskets after pipe sections are joined with feeler gauge to ensure that no displacement of gasket has occurred at point around circumference after joining. If displacement has occurred, remove pipe section and remake joint as if for new pipe. Remove old gasket

and replace before remaking joint.

B. Welded Joints:

1. Conform to requirements of Section 02511 - Water Lines.

2. Field weld to be double-welded lap field joints or full penetration butt welded joints for steel pipe and encasement sleeves for entire circumference.

3. Employ independent certified testing laboratory, approved by Public Works, to perform weld acceptance tests on welded joints. Include cost of such testing in contract unit price bid for water line. Furnish copies of all test reports to Public Works for review. Test by magnetic particle test method for lap welds and fillet welds or by X-ray methods for butt welds, for 100 percent of all joint welds. Public Works has final decision as to suitability of welds tested.

C. Flanged Joints: Conform to requirements of Section 02511 - Water Lines.

D. Joint Grouting and Testing: Conform to requirements of Section 02511 - Water Lines.

E. Do not allow steel plugs for threaded outlets to project beyond inner surface of pipe shell and seal weld by at least two passes. Apply weld around outside of plug after it has been inserted in final position. Coat outlets and plugs inside and outside as required at field joints on pipe.

3.05 FIELD-APPLIED CEMENT-MORTAR LINING

A. Entrances Into Pipeline:

1. Establish means to permit entry and exit of labor, materials and equipment necessary for progress of work, as approved by Public Works.

2. Provide dikes and channeling for diversion of flood and drainage waters away from these openings in pipeline. Use temporary airtight covers over openings to provide proper curing conditions in completed sections of lined pipe. Where operation of equipment requires that end of pipe be left open, install temporary bulkhead inside pipe to eliminate direct draft through pipe over completed sections.

3. Brace closure sections of pipeline left out to facilitate field lining above ground to conform as nearly as possible to shape of pipe in

ground and then place cement-mortar lining by machine or hand trowel to same thickness as in adjoining machine-lined sections. Bulkhead sections immediately after being lined to maintain proper curing conditions for period of not less than 48 hours before sections are installed in pipeline. Install these sections of steel pipe.

4. Coat exterior surface of buttstraps and uncoated exterior surface area of steel pipe within excavations in accordance specifications. Place cement-mortar lining inside areas of joints in accordance with specifications.

B. Mixing of cement-mortar: Mix ingredients for cement-mortar for not less than 1-1/2 and not more than 6 minutes; use mortar promptly after mixing for lining pipe. Do not use mortar that has attained its initial for lining. Do not retemper mortar. Add water to mix last.

C. Placing cement-mortar Lining:

D. Complete joint work, backfill and welding before cement-mortar lining begins. After cement-mortar lining has cured hydrostatic testing of pipe can begin.

E. Provide provisions necessary for Public Works to conduct inspections of work in safe and thorough manner during and after initial application of mortar and after necessary repairs made. Include, as minimum, space on application machine, and adequate lighting to inspect gross surface areas

F. Comply with ASTM C 494 and with manufacturer's recommendations when using chemical admixtures, bonding agents, accelerators, and other additives.

G. Remove dirt, debris, oil, grease and loose mill scale and rust from interior surfaces of pipe, and scrape or brush surface with stiff bristle brush and/or water blast as may be necessary, and approved by Public Works, to ensure clean surfaces for successful application of cement-mortar lining. Interior surfaces to be approved by Public Works prior to placing lining.

H. Provide cement-mortar lining uniform in thickness along entire length of pipe. Provide cement-mortar no less than ½-In. over all surfaces with tolerance of plus 1/8-In., and no allowance for minus tolerance.

I. Mechanically control travel of machine and rates of discharge of mortar to produce uniform thickness of lining without segregation around perimeter and along length of pipe.

J. Check finished surface by placing 12-In. straightedge parallel to axis of

pipe along surface of straight section of lining. At no point will space between lined surface and straightedge be greater than 1/16-In..

K. Provide smooth finished surface, within tolerances specified. Repair or replace surface irregularities including corrugations, ripples, or pits in any direction, to satisfaction of Public Works. Remove defective lining material, including, sand pockets, voids, oversanded areas, blisters, delaminations, or unbounded areas, cracked areas, irregular surfaces, and unsatisfactory thin spots. Remove to pipe wall and area repaired to full thickness of mortar lining.

L. Repair cracks 1/16-In. and larger to satisfaction of Public Works.

M. Place cement-mortar lining by machine having following features:

a. An applicator head which can be centered within pipe and which will centrifugally project mortar against wall of pipe at high velocity producing dense, uniformly distributed mortar on wall of pipe.

b. Equipped with mechanically driven, rotating steel trowels that immediately follow applicator, providing smooth, hard surface without spiral shoulders. Compensate for torque so that machine will sit true in pipe and trowel faces will not vary in angle with mortar face during complete 360-degree cycle. Clean trowels at frequent intervals to prevent accumulated mortar from obtaining initial set resulting in sanded or unglazed finish. Continuously operate trowels during application of cement-mortar and forward progress of lining machine.

c. Design applicator so that nothing will come in contact with troweled surface until it has attained final set, and so that forward progress of machine and mechanical placing of mortar can be controlled to assure uniform thickness of lining.

N. Cement-mortar Lining: Adhere to steel at all points; provide consistent thickness except that lining of bell end of pipe where lining is to be thicker in order to fill depression and make smooth surface.

O. Immediately prior to application of cement-mortar lining, sweep and clean off slime, dirt, loose rust, loose mill scale, and other foreign materials. Free interior surface of pipe after cleaning of accumulated water on pipe wall or at joints.

P. After receiving its finish troweling, do not roughen lining by rebound material or by mortar direct from machine.

Q. Temporarily close outlets in pipeline with easily removable stoppers to prevent spun mortar from being thrown into such openings. After lining is applied, remove stoppers from outlets and repair lining damaged by removal of stoppers. Point outlet openings up to provide smooth flow.

R. Hand Finishing:

1. Repair defective areas in machine-applied lining and unlined joints by hand patching to yield lining equal to that required for machine-applied troweled lining.

2. Provide nonshrink grout for patching or lining joints as specified in this Section.

3. Clean defective areas of loose foreign material and moisten with water just prior to application of hand-applied mortar.

4. Use steel finishing trowels for hand application of cement-mortar.

5. Complete hand finishing required in given pipe section not later than day following machine application of mortar lining to that particular pipe section, whether normal working day or otherwise. Slow down or stop machine application of mortar lining to allow time for hand patching.

S. Curing of Lining: Begin curing operations immediately after completing any portion of mortar lining. Close pipe by airtight bulkheads, and maintain moist atmosphere in completed section of pipe to keep lining damp and to prevent evaporation of entrained water from mortar lining. Humidify air introduced into pipe for ventilating or curing purposes and maintain moist atmosphere inside pipe until Public Works accepts work.

3.06 INSPECTION (EXCEPT MORTAR COATED PIPE)

A. Include cost of inspection described in Paragraph 3.08, Inspection, in contract unit price for water line. Furnish copies of certified inspection reports to Public Works for review.

B. Holiday Test and Adhesion Test: Provide services of independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Provide inspections by NACE trained inspectors under supervision of NACE Certified Coatings Inspector having Level III Certification.

3.07 COATINGS AND LININGS INSPECTION RESPONSIBILITIES

A. Contractor is responsible for quality control of coatings and linings applications and testing and inspection stipulated in this Section. Public Works is responsible for quality assurance and reserves right to inspect or acquire services of independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high- performance coatings at phases of coatings and linings, field or shop applied. Contractor is responsible for proper application and performance of coatings and linings whether or not Public Works provides such inspection.

B. Cement Mortar Lining and Joint Finish: Finished surface of lining and joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat and uniform-appearing finish.

3.08 FIELD REPAIR PROCEDURES AND SPECIAL FITTINGS APPLICATION FOR CEMENT MORTAR LINING

A. Areas less than or equal to 6-In. in diameter: Patch honeycomb and minor defects in concrete surfaces with nonshrink grout. Repair defects by cutting out unsatisfactory material and replacing with nonshrink grout, securely bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off grout flush with surrounding surface.

B. Areas greater than 6-In. in diameter:

1. Remove defective lining down to bare steel by chipping, making sure care is taken to prevent further lining damage. Ends of lining where defective lining is removed are to be left square and uniform not feathered.

2. Clean bare steel with wire brush to remove loose or other foreign matter.

3. Remove existing wire reinforcement and replace. Overlap new reinforcement to existing reinforcement by ½-In. Secure reinforcement, against wall of pipe, at frequent intervals, by tack welding to pipe.

4. Prepare cement mortar mixture. Mixture to compose of Portland Type II cement, sand, and water. Proportions of sand to cement not to exceed 3 parts sand to 1 part cement, by weight. Use only enough water to obtain proper placement characteristics. Set up time before mixture is to be discarded is to be no longer than 1/2 hour. Nonshrink grout may also be used. Do not use combination of cement mortar and nonshrink grout within same repair.

5. Apply WELD-CRETE, or approved equal, concrete bonding agent to bare steel and interface of existing lining. After bonding agent is applied to steel and lining new mix must be applied within 10 minutes.

6. Apply cement mortar to repair area ½-In. thick then hand trowel to achieve smooth dense finish, making sure wire is not left exposed. To ensure proper thickness while placing new mortar, check thickness with ½-In. long wire gauge.

7. Curing: Place plastic sheeting over repair area, use tape to adhere plastic to area surrounding repair area. Let cure for 4 days then remove plastic sheeting.

END OF SECTION

SECTION 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

2. When Public Works directs Contractor to overexcavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6" Overexcavation of Trench Bottom.

   a. No payment will be paid if Public Works does not direct Contractor to overexcavate trench bottom.

   b. No overexcavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 - Control of Ground Water and Surface Water.

3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost for unit price for work requiring critical location.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-

excavations.

B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12-inch above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4-inch in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, educators, or deep wells. Ground water control includes

dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.

    a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.

    b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to

allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.

O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.

P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.

Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 02260 - Trench Safety Systems.

S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave- in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.

T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.

U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

1.04 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.

B. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil

in Place by Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Particle Size Analysis of Soils.

L. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SCHEDULING

A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit planned typical method of excavation, backfill placement and compaction including:

1. Trench widths.

2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.

3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.

C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

D. Submit trench excavation safety program in accordance with requirements of Section 02260 - Trench Safety System. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.

E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

F. Submit 11-inch by 17-inch or 12-inch by 18-inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Public Works.

1.07 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

1.08 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12-inch is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which

are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 EXECUTION

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

C. Classification of material will be determined by Public Works.

3.02 PREPARATION

A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Section 02260 - Trench Safety Systems.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Public Works and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground Water and Surface Water. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed.

3.03 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2-foot vertically and 4-foot horizontally of proposed work.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.

2. Notify Public Works in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Public Works is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Public Works with 48

hours notice prior to field excavation or related work.

C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12-inch by 18-inch copy of Drawings. For large diameter water lines, submit to Public Works for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

3.04 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to the City.

3.05 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.).

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
Less than 18	O.D. + 12
18 to 30	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Public Works and obtain instructions before proceeding.

F. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.

2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.

3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Public Works. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.

4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch thick steel plate. As sheeting is removed, fill in voids left with grouting

material.

G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.

5. Conform to applicable Government regulations.

H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by Pipeline Company’s representative. Use small, rubber- tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1-foot of Pipeline Company’s line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company’s representative.

K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy- acetylene weld is exposed, immediately notify Public Works. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

3.06 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.07 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. When wet soil is encountered on trench bottom and dewatering system is not required, overexcavate an additional 6-inch with approval by Public Works. Place non-woven geotextile fabric and then compact 12-inch of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, if directed by Public Works, in accordance with Paragraph 3.07B above. Removal of unstable or unsuitable material may be required if approved by Public Works;

1. Even though Contractor has not determined material to be unsuitable, or

2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 - Control of Ground Water and Surface Water.

D. Place trench dams in Class I foundations in line segments longer than 100-foot between manholes and not less than one in every 500-foot of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5-foot from manholes.

3.08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. Use bedding material as detailed below and as specified in Section 02320 - Utility Backfill Material.

1. Water line installation: Class I, and II Embedment Materials as specified in Section 02320 - Utility Backfill Material. The City requires water and sewer utilities to be encased a minimum of six (6") inches from the outside diameter of pipe.

a. Maximum 6-inch compacted lift thickness.

b. Compact to achieve minimum of 80 percent of maximum dry density as determined according to ASTM D 698. Avoid damaging pipe.

c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.

2. Sewer line installation: Class I Embedment Materials. The City requires water and sewer utilities to be encased a minimum of six (6") inches of the pipes outside diameter.

a. Maximum 6-inch compacted lift thickness.

b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.

c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.

3. Storm sewer installation: Class II Embedment or Cement Stabilized Sand.

a. Maximum 6-inch compacted thickness.

b. Compact to achieve minimum of 80 percent of maximum dry density as determined according to ASTM D 698. Avoid damaging pipe.

c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D

558 but sufficient for effective hydration.

K. Place trench dams in Class I embedment in line segments longer than 100-foot between manholes, and not less than one in every 500-foot of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5-foot from manholes.

3.09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.

B. In unpaved areas, backfill trench zone, including auger pits, intermediate and site pits, with native material from trench, Class III material, Select Backfill, or random backfill material as specified in Section 02320 - Utility Backfill materials.

1. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift. Maximum 12-inch compacted lift thickness.

2. Compact by vibratory equipment to minimum of 90 percent of maximum dry density determined according to ASTM D 698.

3. Moisture content within zero percent to +5 percent of optimum determined according to ASTM D 698, unless otherwise approved by Public Works

C. For trench zone backfill of in paved areas and to within 1-foot back of curb, use material excavated from trench that meets the requirements of Select Backfill, Select Backfill, or flexible base material, as specified in Section 02320 - Utility Backfill materials. The use of flowable fill may be required in areas subjected to traffic, per Drawings and Section 02320 – Utility Backfill Materials.

1. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift. Place in maximum 8-inch loose layers.

2. Compaction by equipment providing tamping or kneading impact to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

3. Moisture content within 2 percent below or 5 percent above optimum determined according to ASTM D 698, unless approved by Public Works.

D. Cement-Stabilized Sand may be used as trench zone back fill under paved areas.

1. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12-inch Refer to Section 02321.

2. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.

3. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

E. Fat Clay (CH)

1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at any additional cost to City, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.

2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.

3. Compact to minimum of 95 percent of maximum dry density determined according to ASTM D 698. Moisture content as necessary to achieve density.

F. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5-foot or more above crown of pipe. Remove trench supports within 5-foot from ground surface.

G. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Meet requirements of adjoining utility installations for backfill of pipeline structures, as shown on Drawings.

B. Below paved areas, encapsulate manhole with cement stabilized sand or flowable fill; minimum of 1-foot below base, minimum 1-foot around walls, up to within 12-inch of pavement subgrade. Compact in accordance with Paragraph 3.10.D of this Section

C. In unpaved areas, use Select Backfill, or flexible base material, for backfill.

Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Public Works. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to City.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Public Works.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 698, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.

1. For open cut construction projects and auger pits: Unless otherwise approved by Public Works, successful compaction to be measured by one test per 400-foot measured along pipe.

2. A minimum of three density tests for each full shift of work.

3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.

4. The number of tests will be increased if inspection determines that

soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at same frequency as first test series, including verification tests.

8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, recompact, and retest at Contractor's expense if tests indicate work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 – Waste Material Disposal.

END OF SECTION

SECTION 02520

FIRE HYDRANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire hydrants.

B. Adjustment of fire hydrants and gate valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on a unit price basis for each fire hydrant assembly, including 6-In. gate valve and box, lead, pavement marker, installed regardless of barrel depth.

2. No separate payment will be made for fire hydrant branches (leads). Include cost in unit price for assembly.

3. Payment for salvaged fire hydrants is on unit price basis for each fire hydrant removed and returned to the City's Maintenance yard.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C502-05 Standard (ANSI/AWWA C502-05) or latest revision.

B. National Fire Protection Association (NFPA) 2003, Standard for Fire Hose Connections.

B. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants

C. SSPC SP2 - Hand Tool Cleaning

D. SSPC SP3 - Power Tool Cleaning

E. SSPC SP10 - Near-White Blast Cleaning

F. SSPC SP11 - Power Tool Cleaning to Bare Metal

G. SSPC Paint Spec No.21

H. SSPC-Paint 21 - White or Colored Silicone Alkyd Paint

I. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

J. SSPC-Paint 104 - White or Tinted Alkyd Paint

K. Federal Standard A-A-2962A - Enamel, Alkyd, Solvent Based Low VOC

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

PART 2 PRODUCTS

2.01 HYDRANTS

A. Provide approved fire hydrants conforming to AWWA C 502 Standards, with a 5 ¼" main valve opening nominal diameter. Approved manufacturers are: Mueller, Kennedy, Clow and East Jordan,

B. The Public Works may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and laboratory inspection, at the City's expense, to verify compliance with Specifications. When hydrant is found to be non-compliant, replace, at Contractor's expense, with hydrants that comply with Specifications.

C. Provide lower hydrant barrel fabricated from Ductile Iron Pipe as single piece, connected to upper hydrant barrel by means of joint coupling that will provide three hundred sixty degree (360) rotation of upper barrel.

D. Five (5-1/4") steamer outlet, NST, and two (2-1/2") outlets

E. Design working pressure of 200 psi and a test pressure of 400 psi.

F Traffic Feature shall have replaceable breakaway ferrous metal stem coupling held to stem by readily removable type 302 or 304 stainless steel fastenings. Breakaway flange or frangible lugs shall be designed to assure

aboveground break. Breakaway or frangible bolts will not be acceptable.

G. Fire hydrant nozzle cap chains shall be required and shall be attached permanently to the fire hydrant as stipulated in AWWA C502.

2.02 LEADS

A. Branches (Leads): Conform to requirements of Section 02501 - Ductile Iron Pipe and Fittings, Section 02502 - Steel Pipe and Fittings, and Section 02506 - Polyvinyl Chloride Pipe.

2.03 HYDRANT PAINTING

A. New hydrants and refurbished hydrants shall be shop coated as specified herein.

B. Exterior above traffic flange (Including Bolts & Nuts).

1. Surface preparation to be in accordance with SSPC-SP 10 (MACE 2) near white blast cleaned surface.

2. Coat with three coat alkyd/silicone alkyd system with total dry film thickness (DFT) of 6-9 mils as follows:

a. Prime Coat - Oil modified alkyd primer, to be in general conformance with SSPC Paint Specification No. 25. Total dry film thickness (DFT) 2-3 mils.

b. Intermediate Coat - Heavy Duty Industrial Alkyd Enamel to be in general conformance with SSPC Paint Specification No. 104, and Federal Standard A-A-2962A. Total dry film thickness (DFT) of 2-3 mils.

c. Finish Coat - Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Total dry film thickness (DFT) to be 2-3 mils. Exception - hydrant bonnet shall not be finished shop coated, only intermediate coated. Install color coded finish coating of bonnet in field.

d. Bonnet Paint - Field apply finish coat of Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Dry film thickness of 2-3 mils. Bonnet colors are to be as specified in Paragraph 3.01 to designate the appropriate size of water supply line.

3. Colors –

Primer: Manufacturers standard color.
Intermediate coat: Contrasting color to red finish, such as white.
Finish coat of hydrant body: RED
Connection caps and Bonnets: Finished coat white.

C. Field Maintenance Painting (Exterior Above Traffic Flange)

1. Surface Preparation to be in accordance with SSPC - SP2, Hand Tool Cleaning, or SSPC - SP3, Power Tool Cleaning, depending on condition of existing paint and extent of corrosion. It is not necessary to remove tightly adhered mill scale, rust, and paint. Mill scale, rust and paint are considered tightly adherent when they cannot be removed with dull putty knife. In some severe cases where it is necessary to remove majority of existing paint, surface should be cleaned in accordance with SSPC -SP11, Power Tool Cleaning to Bare Metal.

2. When surface is cleaned to bare metal (SSPC - SP11), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph 2.03.B.2 as for new hydrants. When surface is cleaned to SSPC - SP2 or SSPC - SP3, coat hydrant with Silicone Alkyd Resin Enamel in general conformance with SSPC Paint Specification No. 21. Total dry film thickness of 3-6 mils.

D. Exterior Below Traffic Flange

1. Surface preparation in accordance with SSPC- SP10 (MACE 2) Near White Blast Cleaned Surface.

2. Primer and intermediate coat: coal tar epoxy in general conformance with SSPC Paint Specification No. 16. Apply two (2) coats with dry film thickness (DFT) of 8-10 mils each for total DFT of 16-20 mils.

3. Finish coat: Water based vinyl acrylic mastic. Apply one coat with dry film thickness of 6-8 mils. Color of finish coat to be same as finish coat for exterior above traffic flange, i.e., blue. (Acro 555 Crystal Blue, or equivalent.)

E. Interior Surfaces Above and Below Water Line Valve

1. Material used for internal coating of hydrant interior ferrous surfaces below water line valve must be NSF 61 certified.

2. Coating shall be liquid or powder epoxy system in accordance with AWWA Standard C - 550 (latest revision). Coating may be applied

in two or three coats, according to manufacturer's recommendations, for total dry film thickness of 12-18 mils.

PART 3 EXECUTION

3.01 INSTALLATION

A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place 1-In. thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.

B. Locate nozzle center line minimum 18-In. above finish grade, facing street. Set so that no portion of the pumper or hose nozzle cap will be less than 24 inches nor more than 7'-0" from the face of the curb and the bury line on the barrel shall be level with the top of the curb. It is also intended that no portion of the hydrant or nozzle cap shall be within 6-inches of the sidewalk.

C. A blue Type II reflector pavement marker, conforming to Section 02764 Raised Pavement Markers, shall be placed 2 to 3 feet (0.6 to 0.9 meters) offset from the centerline of paved streets, on the side of and in line with, all newly installed fire hydrants.

D. The bowl of each hydrant shall be securely braced against undisturbed earth at the end of the trench with concrete thrust blocking. Do not cover drain ports when placing concrete thrust block.

E. Obtain Public Works approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water line flow line or fire hydrant barrel length caused by obstructions.

F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed. Deliver fire hydrants designated for salvage to nearest Utility Maintenance Facility.

G. Install branches (leads) in accordance with Section 02511 - Water Lines.

H. Coating Requirements:

1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.

2. Furnish affidavit of compliance that coatings furnished complies

with requirements of this specification and referenced standards, as applicable.

I. Remove and dispose of unsuitable materials and debris in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

SECTION 02521

GATE VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gate valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for gate valves through 16-In. in diameter is on a unit price basis. Unit price includes cost of required valve box and riser for gate valves.

2. Payment for 2-In. blow-off valve with valve box and riser is on a unit price basis for each installation.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

B. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.

C. ASTM D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.

D. ASTM B 763 - Standard Specification for Copper Alloy Sand Casting for Valve Application.

E. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.

F. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply

Service.

G. AWWA C 515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.

H. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

1.05 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open counterclockwise; aboveground and plant valves open counterclockwise. Acceptable Manufacturers: Mueller, Clow, Kennedy

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 16-In. and smaller. When type of valve is indicated, no substitute is allowed.

C. Gate Valves 1 1/2-In. in Diameter and Smaller: 125 psig; bronze; rising-stem; single- wedge; disc type; screwed ends

D. Coatings for Gate Valves 2-In. and larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-Mil thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.

E. Gate Valves 2-In. in diameter: Iron body, double disc or resilient-seated, non-rising stem, 150-pound test, 2-In. square nut operating clockwise to

open.

F. Gate Valves 4-In. to 12-In. in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), 200 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Comply with following requirements unless otherwise specified in Drawings:

1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.

2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.

3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.

4. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-In. of 12 percent, non-rising.

5. O-rings: For AWWA C 509, Sections 2.2.6 and 4.8.2.

6. Stem Seals Consist of three O-rings, two above and one below thrust collar with anti- friction washer located above thrust collar for operating torque.

G. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.

H. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

I. Bolts: AWWA C 509 Section 4.4; stainless steel; cadmium plated, or zinc coated.

G. Gate valves 16-In. and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig pressure rating. Comply with following requirements unless otherwise specified on Drawings:

1. Body: Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured When horizontally mounted, equip valves greater in diameter than 12-In. with rollers, tracks, and scrapers.

2. O rings: For AWWA C 500, Section 3.12.2. For AWWA C 515, Section 4.2.2.5.

3. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-In. of 12 percent, non-rising.

4. Stem Nut: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.

5. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti- friction washer located above thrust collar for operating torque.

6. Bolts: AWWA C 500 Section 3.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

7. Discs: Cast iron with bronze disc rings securely penned into machined dovetailed grooves.

8. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.

9. Provide bypass for valves 24-In. and larger.

10. Bronze Mounting: Built as integral unit mounted over, or supported on. Cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.

11. Gear Cases: Cast iron; furnished on 18-In. and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.

12. Stuffing Boxes: Located on top of bonnet and outside gear case.

H. Gate valves 14-In. to 16-In.: Provide AWWA C 515; reduced-wall, resilient seated gate valves with 250 psig pressure rating. Furnish with spur or bevel gearing.

1. Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.

2. Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.

3. Ensure wedge is symmetrical and seals equally well with flow in either direction.

4. Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.

5. Bolts: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.

6. Provide high strength bronze stem and nut.

7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.

8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.

9. Provide thrust washers to the thrust collar for easy valve operation.

I. Gate Valves Extension Stem: When shown on Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4-Ft. from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

J. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

K. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.

L. Provide flanged joints when valve is connected to steel.

M. All gate valves to be NSF 61 approved.

PART 3 EXECUTION

3.01 INSTALLATION

A. Earthwork. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities.

B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.02 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4-Ft., or to undisturbed trench face when less than 4-Ft. Install valves completely closed when placed in water line.

C. Riser must be installed to allow complete access for operation of valve. Assemble and brace box in vertical position as indicated on Drawings.

3.03 DISINFECTION AND TESTING

A. Assist Public Works with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Water Lines and test as required by Section 02515 – Hydrostatic Testing of Pipelines.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not

exceed leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

3.04 PAINTING OF VALVES

A. Paint valves in vaults, stations, and above ground with approved paint. See Section 09905 Cleaning And Painting Exposed Piping, Valves And Related Items.

END OF SECTION

SECTION 02522

BUTTERFLY VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Butterfly valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for butterfly valves will be on unit price basis for each. Unit price includes cost of required valve box and riser for gate valves

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

C. AWWA C 504 - Standard for Rubber-Seated Butterfly Valves.

D. AWWA C 550 - Standard for Protective Interior Coatings for Valves and Hydrants.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves and actuators for approval.

C. Submit manufacturer's affidavit for proposed valves and actuators certifying compliance with specifications.

D. Submit manufacturer's affidavit that butterfly valves were manufactured in the United States, and conform to applicable requirements of AWWA C 504 and that they have been satisfactorily tested in the United States in accordance with AWWA C 504 using test pressure of 150 psi in both directions. Submit Proof-of-Design and hydrostatic testing procedure in accordance with AWWA C 504.

E. Submit manufacturer's affidavit that coating for interior surfaces of valves conform to applicable requirements of AWWA C 550. Submit results of holiday test and thickness measurements of coatings.

F. Furnish, at time of delivery, affidavit of compliance, as specified in Section 6.3 of AWWA C 504 certifying compliance with applicable portion of AWWA C 504 and modification or supplements herein. Furnish certified drawings and material test records by manufacturer covering items included in Section 4.3 of AWWA C 504, for review. Furnish certified copies of test reports covering items in Sections 4.5.8.5.5, 4.5.8.5.8 and 5.2.1 through 5.2.4.3 of AWWA C 504 for review.

G. Submit data indicating maximum torque required to open valve, maximum torsional strength of shaft and torque output of actuator.

H. Provide submittal information on CD-ROM in Adobe portable document format (*.PDF).

I. Include number of turns to operate valves to fully open/closed.

1.05 QUALITY CONTROL

A. Perform valve leakage tests in both directions at 150 psi in factory and field. Hydrostatic field tests of 150 psi shall be made against dished head plug or similar arrangement.

B. For purposes of interpreting referenced AWWA tests, the following shall apply: Shutoff pressure is 150 psi; cycle consists of rotating disc from fully opened to fully closed position, for valves larger than 72-In., proof of design shall require 1000 cycles and shall be performed on valve greater than 72-In. of like design and construction. When proof of design tests are performed on valve delivered to job site, replace disc, bushing, shaft and seals with new and unused items, and test and certify as described above.

C. Hydrostatic Testing by Manufacturer:

1. Document serial number on valve at time of testing and reflect in certified test records furnished to Public Works. Identification plate must be permanently affixed to valve and actuator prior to

hydrostatic testing.

2. Hydrostatic testing by manufacturer to conform to AWWA C504.

3. Field Testing

a. When valve arrives at the job site, Contractor is to operate valve fully open and closed twice in presence of Public Works. Document number of turns to open and close each time.

b. Install operator nut plum.

c. After valve is installed, repeat the operation test and document number of turns in presence of Public Works.

d. Manufacturer's representative must be present to witness the operation test again at the substantial walk thru. Verify valve operate fully open/closed twice at the appropriate number of turns.

PART 2 PRODUCTS

2.01 VALVES AND ACTUATORS

A. Butterfly Valves and Actuators: Provide approved butterfly valves and actuators. Conform to AWWA C 504, except as modified or supplemented herein. Acceptable Manufacturers: Pratt

B. If type of valve is not indicated on Drawings, use butterfly valves for line valve sizes 20-In. and larger. When type of valve is specified on Drawings, no substitute will be allowed, unless otherwise approved by Public Works.

C. Butterfly valves shall be short-body, flanged design and installed at locations as shown on Drawings.

D. Valves shall open counterclockwise.

E. Butterfly Valves and Actuators (Additional Requirements for Large Diameter Water
Lines):

1. Provide valves from approved manufacturer. Provide all valves for single project, from same manufacturer.

2. Provide manual actuators for single project, from same manufacturer.

3. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension are to be fully enclosed and watertight.

2.02 VALVE CONSTRUCTION

A. Valves: AWWA C 504, Class 150B. Body: Cast iron, ASTM A 126, Class B or ASTM A48, Class 40. Flanges: ASME B 16.1, Class 125 lb.

B. Discs for Butterfly Valves: Cast Iron A-48, class 40 Cast Iron A-126, class B or Ductile Iron ASTM A-536, grade 65-45-12.

C. Seats: Buna-N or neoprene, and may be applied to disc or body. Seats shall be mechanically secured and may not rely solely on adhesive properties of epoxy or similar bonding agent to attach seat to body. Seats on disc shall be mechanically retained by stainless steel (18-8) retaining ring held in place by stainless steel (18-8) cap screws that pass through rubber seat for added retention. When seat is on disc, seat shall be retained in position by shoulders located on both disc and stainless-steel retaining ring. Mating surfaces for seats: Type 304 or 316, stainless steel and secured to disc by mechanical means. Sprayed-on or plated mating surfaces will not be allowed. Seat must be replaceable in field for valves greater than 30-In. in diameter. Valves with segmented retaining rings will not be accepted.

D. Coat interior and exterior of valve per AWWA C504. Interior coatings will comply with NSF 61.

E. Valve shaft and keys: 24-In. in diameter and greater valves require a minimum of two (2) taper pins used for attaching valve shaft to valve disc, use of torque plug for purposes of attaching valve shaft to valve disc is not permitted: Type 316 stainless steel. Shaft Bearings: Stainless steel, bronze, nylon, or Teflon (supported by fiberglass mat or backing material with proven record of preventing Teflon flow under load) in accordance with AWWA C 504. Sinter stainless steel bearing material. Design valve shaft to withstand 3 times amount of torque necessary to open valve.

F. Packing: Self adjusting and wear compensating, full or split ring V-type, and replaceable without removing actuator assembly.

G. Retaining Hardware for Seats: Type 304 or 316 stainless steel. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitational effects.

H. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow, except where shown otherwise on Drawings.

I. For valves utilizing retaining rings, tighten bolts to a uniform torque. Measure the torque prior to testing valve.

2.03 VALVE ACTUATOR CONSTRUCTION

A. Provide actuators for valves with size based on line velocity of 12-Ft. per second and uni-directional service, and, unless otherwise shown on Drawings, equip with geared manual actuators. Provide fully enclosed and traveling-nut type, rack-and-pinion type, or worm-gear type for valves 20-In. and smaller. Provide worm-gear type for valves 24-In. and larger.

B. Provide actuator designed for installation with valve shaft horizontal unless otherwise indicated on Drawings.

C. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements.

D. Provide oil-tight and watertight actuator housings for valves, specifically designed for buried service or submerged service when located in valve vaults, and factory packed with suitable grease. Actuators shall be fully grease packed and have stops in the open/close position. The actuator shall have a mechanical stop which will withstand an input torque of 450 ft. lbs. against the stop.

E. Install valve position indicator on each actuator housing located above ground or in valve vaults. Valves shall be equipped with 2-In. actuator nut only.

F. Indicate direction of opening of valve on exposed visible part of assembly and cast direction of open on 2-In. nut on top of valve operator extension. Paint 2-In. actuator nut and extension shaft black when counter clockwise open and red when clockwise to open.

G. Design worm-gear or traveling-nut actuators to be self-locking and designed to transmit twice the required actuator torque without damage to faces of gear teeth or contact faces of screw or nut.

H. The actuator shall be designed to produce the specified torque with an input of 150 ft. lbs. on wrench nut.

2.04 VALVE BOXES

A. Provide Standard Type "A" valve boxes conforming to requirements of Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

PART 3 EXECUTION

3.01 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfill for Utilities.

3.02 SETTING VALVES AND VALVE BOXES

A. Prior to Hydrostatic testing of water line and valve:

1. Test valve by opening and closing valve at a minimum of two times to verify valve seats properly.

2. Verify number of turns from fully open to fully closed position is same as identified in manufacturer's submittal.

3. Adjust valve as required if number of turns do not match.

4. Remove foreign matter from within valves.

B. Install valves where shown on Drawings or as located by Public Works. Use valve boxes for 16-In. and 24-In. valves. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4-Ft., or to undisturbed trench face when less than 4-Ft.

C. Avoid disturbing or overstressing valve body when installing valves. Perform field adjustment of valves under pressure to ensure shutoff occurs in number of rotations as described in valves operation and maintenance manual.

D. Attach two 4-Ft. lengths of pipe to each side of valve prior to installation in line.

E. Submit certification that large diameter valve was installed, adjusted, and exercised in accordance with manufacturer's instructions. Manufacturer's certification shall state that all performance characteristics of large diameter valves, as installed, have been met. Adjustments made to valve, for any reason, must be made by manufacturer's representative.

3.03 DISINFECTION AND TESTING

A. Assist City with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Water Lines and test as required by Section 02515 - Hydrostatic Testing of Pipelines. Do not use valves for throttling without prior approval of manufacturer.

3.04 COATING OF PIPING

A. Coat valves located in vaults, stations, and above ground using approved paint. See Section 09905 Cleaning And Painting Exposed Piping, Valves And Related Items.

END OF SECTION

SECTION 02523

PRESSURE REDUCING VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure reducing valves (PRV).

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for pressure reducing valves is on unit price basis for each valve installed.

2. Payment includes vault, piping, manhole, fittings, and appurtenances necessary for complete installation of valve.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 48 - Standard Specification for Gray Iron Castings.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Submit design calculations and shop drawings for valve vaults and manholes, sealed by Engineer registered in the State of Texas.

1.05 QUALITY CONTROL

A. Submit manufacturer's affidavit that pressure reducing valves purchased for Work, were manufactured and tested in the United States, and conform

to requirements of this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide approved hydraulically operated, single diaphragm, globe valve with an upstream basket strainer arrangement as shown on Drawings.

1. Valve body: ASTM A536 or A538 Ductile iron with ASME B16.1, Class 125, flanges.

2. Valve cover: ASTM A 48 cast iron or Ductile iron.

3. Valve internals:

a. Provide top and bottom single moving disc and diaphragm assembly.

b. All internal cast components shall be Ductile Iron or CF8M (316) Stainless Steel

c. Provide valve internal trim (seat ring, disc guide, and cover bearing) made of stainless steel.

d. Provide NSF 61 Certified epoxy coating to internal and external surfaces of valve body including disc retainer and diaphragm washer. Holiday test coating applied to valve body.

B. Control Tubing: Contain shutoff cocks with Y-strainer.

C. PRV: Equip with visual valve position indicator. Fit valve position indicator with air-bleed petcock. Initially set in field by authorized manufacturer's representative with 60 psi downstream pressure.

D. Provide basket strainer upstream of PRV as shown on Drawings.

1. Strainer body: Quick-opening type, fabricated-steel construction with ANSI B 16.1, Class 150, flanges.

2. Basket: Type 304, stainless steel.

3. Model: Provide basket compatible with the manufacturer of the pressure reducing valve. Hayward Model 90, or approved equal, for PRV 4-In. through 24-In. Provide Hayward Model 510, or approved equal, for PRV 14-In. or greater when space limitations dictate use

of smaller strainer housing.

E. Provide pressure reducing pilot that has adjustable range of 20 - 175 psi. Provide and install pilot system components according to manufacturer's recommendations unless otherwise approved by Public Works.

F. Valve Vaults: Provide as shown on Drawings and conforming to requirements of Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

PART 3 EXECUTION

3.01 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfill for Utilities.

3.02 SETTING VALVES

A. Provide services of technical representative of valve manufacturer on site during installation of valves and to serve as adviser on aspects of installation. Take necessary precautions to protect pilot system during PRV installation.

B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.

3.03 DISINFECTION AND TESTING

A. Disinfect valves and appurtenances as required by Section 02514 - Disinfection of Water Lines and test as required by Section 02515 - Hydrostatic Testing of Pipelines.

3.04 PAINTING OF PIPING AND VALVES

A. Paint piping and valves located in vaults, stations, and above ground. See Section 09905 Cleaning and Painting Exposed Piping, Valves and Related Items.

END OF SECTION

SECTION 02524

AIR RELEASE AND VACUUM RELIEF VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air release and vacuum relief valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for air release and vacuum relief valves is on unit price basis for each valve installed.

2. Payment includes manhole or vault (when required), fittings, vent piping and bollard(s) and appurtenances necessary for complete installation of valve.

3. Payment for valve assembly on aerial crossing includes fittings, anti-vandalism protection, freeze protection, vent piping and appurtenances necessary for complete installation of valve.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 48 - Standard Specification for Gray Iron Castings.

B. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

C. ASTM A 240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.

D. ASTM A 276 - Standard Specification for Stainless Steel Bars and Shapes.

E. ASTM A 313 - Standard Specification for Stainless Steel Spring Wire.

F. ASTM B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

1.05 QUALITY CONTROL

A. Provide manufacturer's affidavit that air release and vacuum relief valves purchased for Work, were manufactured and tested in United States, and conform to requirements of this Section.

PART 2 PRODUCTS

2.01 DESCRIPTION

A. Provide combination air valves designed to fulfill functions of air release (permit escape of air accumulated in line at high point of elevation while line is under pressure) and vacuum relief.

B. Provide inlet and outlet connections, and orifice as shown on Drawings.

C. Valve exterior: Painted with shop-applied primer suitable for contact with potable water.

2.02 MATERIALS

A. Air Release Valves: Provide approved air release valves ASTM A 48, Class 30, cast iron; float and leverage mechanism with body and cover, ASTM A 240 or ASTM A 276 stainless steel; orifice and seat, stainless steel against Buna-N or Viton mechanically retained with hex head nut and bolt. Other valve internals shall be stainless steel or bronze.

B. Air Release and Vacuum Relief Valves: Provide single-body, standard combination valves or duplex-body custom combination valves as indicated on Drawings.

1. For 2-In. and 3-In., single-body valves, provide inlet and outlet size as shown on Drawings and orifice sized for 100 psi working pressure.

a. Valve materials: Body, cover, and baffle, ASTM A 48, Class

35, or ASTM A 126, Grade B cast iron; plug or poppet, ASTM A 276 stainless steel; float, ASTM A 240 stainless steel; seat, Buna-N; other valve internals, stainless steel.

2. For 3-In. and larger duplex body valves as shown on Drawings, provide approved air release valve.

a. Air and vacuum valve materials: Body and cover, ASTM A 48, Class 35, cast iron; float, ASTM A 240 stainless steel; seat, Type 304, stainless steel and Buna-N; other valve internals, stainless steel or bronze.

b. Air release valve: Constructed as specified in paragraph above on Air Release Valves.

C. Vacuum Relief Valves: Provide approved air inlet vacuum relief valves with flanged inlet and outlet connections as shown on Drawings. Provide air release valves in combination with inlet and outlet, and orifice as shown on Drawings. Valve shall open under pressure differential not to exceed 0.25 psi.

1. Materials for vacuum relief valves: Valve body, ASTM A 48, Class 35, cast iron; seat and plug, ASTM B 584 bronze, copper alloy 836; spring, ASTM A 313, Type 304, stainless steel; bushing, ASTM B 584 bronze, copper alloy 932; retaining screws, ASTM A 276, Type 304, stainless steel.

D. Manholes: As shown on Drawings conforming to requirements of Section 02082 – Precast Concrete Manholes.

PART 3 EXECUTION

3.01 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfill for Utilities.

3.02 SETTING VALVES IN MANHOLES AND VAULTS

A. If required by Public Works, provide services of technical representative of valve manufacturer available on site during installation of valves.

B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.

C. Install valves and valve manholes and vaults where indicated on Drawings or as located by Public Works. Set manholes and vaults plumb and as detailed. Center the manholes on valves. Compact cement-stabilized sand around each manhole and vault for minimum radius of 4-Ft., or to undisturbed trench face when less than 4-Ft. Provide above-ground vents for manholes and vaults as indicated on Drawings.

3.03 DISINFECTION AND TESTING

A. Assist City with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Waterlines and test as required by Section 02515 - Hydrostatic Testing of Pipelines.

3.04 PAINTING OF PIPING AND VALVES

A. Paint piping and valves located in manholes, stations, and above ground using approved paint. See Section 09905 Cleaning and Painting of Exposed Piping, Valves, and Related Items.

END OF SECTION

SECTION 02525

TAPPING SLEEVES AND VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tapping sleeves and valves for connections to existing water system.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on unit price basis for each tap installed.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

3. For water lines 4-In. and greater, no payment will be made until coupon (cut out portion of pipe tapped) is delivered to the City.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

B. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

C. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High- Pressure or High-Temperature Service

D. AWWA C 110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3-In. through 48-In., for Water and other Liquids.

E. AWWA C 200 - Standard for Steel Water Pipe – 6-In. and Larger.

F. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4-In. Through 144-In.

G. AWWA C 500 - Standard for Metal Seated Gate Valves, for Water Supply

Service.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit results of tapping sleeves NPT test opening.

C. Submit manufacturer's affidavit as required in Section 02521 - Gate Valves.

1.05 DELIVERY, STORAGE AND HANDLING

A. Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tapping Sleeves:

1. Tapping Sleeve Bodies: AWWA C 110 cast or ductile iron or AWWA C 200 carbon steel in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.

2. Branch Outlet of Tapping Sleeve:

a. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.

b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.

3. Use cast iron split sleeve where fire service from 6-In. water line is approved.

B. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

1. Flange: AWWA C 207, Class D, ANSI 150 pound drilling.

2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.

3. Steel sleeves are restricted to use on pipe sizes 6-In. and larger.

4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O-ring seal permanently against outside diameter of pipe.

5. Bolts: AWWA C 500 Section 3.5; coated with 100 percent vinyl resin or corrosive resistant material.

6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum 12Mil. thickness.

7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.

8. Provide approved steel tapping sleeves

9. Tapping Sleeves: Provide with 3/4-In. NPT test opening for testing prior to tapping. Provide 3/4-In. bronze plug for opening.

10. Do not use steel sleeves for taps greater than 75 percent of pipe diameter.

C. Stainless Steel tapping-sleeve bodies and flange may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

1. Flange: ASTM A240 Stainless Steel, Type 304, ANSI 150 pound drilling.

2. Gasket: Full circumferential, affixed around recess of tap opening to prevent rolling or binding during installation, compounded for water and sewer service.

3. Stainless Steel sleeves are restricted to use on pipe sizes 4-In. and larger.

4. Body: ASTM A240 Stainless Steel, Type 304.

5. Bolts: ASTM A193 Stainless Steel, Type 304.

6. Nuts: ASTM A194 Stainless Steel, Type 304

.

7. Branch Outlet: Heavy Stainless Steel Pipe

8. Provide approved stainless steel tapping sleeves.

9. Do not use stainless steel sleeves for taps greater than 75 percent of

pipe diameter.

C. Tapping Valves: Meet requirements of Section 02521 - Gate Valves with following exceptions:

1. Inlet Flanges:

a. AWWA C 110; Class 125.

b. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.

2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.

3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.

D. Valve Boxes: Standard Type "A" valve boxes conforming to requirements of Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

PART 3 EXECUTION

3.01 APPLICATION

A. Install tapping sleeves and valves at locations and of sizes shown on Drawings. Install sleeve so valve is in horizontally level position unless otherwise indicated on Drawings.

B. Clean tapping sleeve, tapping valve, and pipe prior to installation and in accordance with manufacturer's instructions.

C. Hydrostatically test installed tapping sleeve to 150 psig for minimum of 15 minutes. Inspect sleeve for leaks, and remedy leaks prior to tapping operation.

D. When tapping concrete pressure pipe, size on size, use shell cutter one standard size smaller than water line being tapped.

E. Do not use Large End Bell (LEB) increasers with next size tap unless existing pipe is asbestos-cement.

3.02 INSTALLATION

A. Verify outside diameter of pipe to be tapped prior to ordering sleeve.

B. Tighten bolts in proper sequence so that undue stress is not placed on pipe.

C. Align tapping valve properly and attach to tapping sleeve. Insert insulation sleeves into flange holes of tapping valve and pipe. Make insertions of sleeves on pipe side of tapping valve. Do not damage insulation sleeves during bolt tightening process.

D. Make tap with sharp, shell cutter:

1. For 12-In. and smaller tap, use minimum cutter diameter ½-In. less than nominal tap size.

2. For 16-In. and larger tap, use manufacturer's recommended cutter diameter.

E. Withdraw coupon and flush cuttings from newly-made tap.

F. Wrap:

1. For 12-in. and smaller tap, wrap completed tapping sleeve and valve in accordance with Section 02528 - Polyethylene Wrap.

2. For 16-In. and larger tap, apply coal tar epoxy around completed tapping sleeve and valve. The coal tar epoxy shall be applied with minimum of two (2) coats. Each coat of coal tar epoxy shall have minimum dry film thickness of 16-Mils.

G. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).

H. Request inspection of installation prior to backfilling.

I. Backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION

SECTION 02527

POLYURETHANE COATINGS ON STEEL OR DUCTILE IRON PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Two-component polyurethane coating system for use as external coating for steel or ductile iron pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of polyurethane coatings in contract unit prices for steel pipe or ductile iron pipe.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 210 - Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

B. ASTM D 522 - Standard Test Method for Mandrel Bend Test of Attached Organic Coatings.

C. SSPC-PA 2 - Measurement of Dry Paint Thickness with Magnetic Gauges.

D. SSPC-PA Guide 3 - A Guide to Safety in Paint Application.

E. SSPC-PS Guide 17.00 - Guide for Selecting Urethane Painting Systems.

F. SSPC-PS10 - Near-White Blast Cleaning.

1.04 SAFETY

A. Secure, from manufacturer, Material Safety Data Sheet (MSDS) for polyurethane coatings and repair materials listed in this Section.

B. Safety requirements stated in this specification and in related sections apply in addition to applicable federal, state and local rules and regulations. Comply with instructions of coating manufacturer and requirements of insurance underwriters.

C. Follow handling and application practices of SSPC-PA Guide 3; SSPC-PS Guide 17.00; Coating Manufacturer's Material Safety Data Sheet.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit coating manufacturer's catalog sheets and technical information for approval, prior to delivery of pipe.

C. Obtain from coating manufacturer and submit coating "affidavit of compliance" to requirements of this Section stating that coatings were applied in factory and in accordance with manufacturer's minimum requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Use standard containers to prevent gelling, thickening deleteriously or forming of gas in closed containers within period of one year from date of manufacture.

B. Label each container of separately packaged component clearly and durably to indicate date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name or formula specification, number of coatings together with special instructions. Do not use coating components older than one year.

C. Deliver coating materials to pipe manufacturer in sealed containers showing designated name, batch number, color, date of manufacture and name of coating manufacturer.

D. Store material onsite in enclosures, out of direct sunlight in warm, ventilated and dry area.

E. Prevent puncture, inappropriate opening or other action which may lead to product contamination.

PART 2 PRODUCTS

2.01 COATING MATERIAL

A. CORROPIPE II PW - TOUCHUP (two-component) or approved equal;

mix in accordance with coating manufacturer's recommendations.

1. For areas less than or equal to 6-In. in diameter, brush apply.

2. For areas greater than 6-In. in diameter, spray apply.

B. Coating System: Use Type V system which is 2-package polyisocyanate, polyol-cured urethane coating, mixed in 1:1 ratio at time of application. Components shall be balanced viscosities in their liquid state and not require agitation during use.

C. Exterior Coating Material: CORROPIPE II-TX and Joint Coating Material CORROPIPE II- PW, manufactured by Madison Chemical Industries, Inc.

D. Internal Coating Material: Joint Coating Material CORROPIPE II-PW, manufactured by Madison Chemical Industries, Inc

E. Cured Coating Properties:

1. Conversion to Solids by Volume: 97 percent plus or minus 3 percent.

2. Temperature Resistance: Minus 40 degrees F and plus 130 degrees F.

3. Minimum Adhesion: 500 psi, when applied without primer to ductile iron pipe which has been blasted to comply with SSPC-SP 10.

4. Cure Time: For handling in 1 minute at 120 degrees F, and full cure within 7 days at 70 degrees F.

5. Maximum Specific Gravities: Polyisocyanate resin, 1.20. Polyol resin, 1.15.

6. Minimum Impact Resistance: 80-In.-pounds using 1-In. diameter steel ball where coating is applied at 30 mils to ductile iron pipe surface which has been blasted to SSPC No. 10 finish.

7. Minimum Tensile Strength: 2,000 psi.

8. Hardness: 55 plus or minus 5 Shore D at 70 degrees F.

9. Flexibility Resistance: ASTM D 522 using 1-In. mandrel. Allow coating to cure for 7 days. Perform testing on test coupons held for 15 minutes at temperature extremes specified in this Paragraph.

2.02 2.02 REPAIR AND TOUCHUP MATERIAL

A. CORROPIPE II PW (Two-component, brush applied, or approved equal). Mix in accordance with coating manufacturer's recommendations.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Remove deposits of oil, grease or other organic contaminates before blast cleaning by using solvent wash as specified in SSPC-PA Guide 3. Clean and dry surfaces making them completely dry, free of moisture, dust, grit, oil, grease or other deleterious substances prior to application of coating.

B. Exterior and Interior Surfaces: SSPC-SP10, near-white metal blast cleaning. Blast with clean, hard, sharp cutting abrasives with no steel or cast iron shot in mix.

C. Ductile Iron Pipe: Prior to start of production blasting, prepare specimens for white metal blast and near-white metal blast using equipment and abrasives proposed for work. During preparation of specimens, Change blasting intensity and abrasive as necessary to provide degree of cleaning required by SSPC-SP10, except that color of blasted substrate is not expected to match color of blasted steel. After examination and concurrence by Public Works, production blasting may begin. Monitor and control production blasting so that production pipe surfaces match surface of approved blasting specimens.

3.02 THICKNESS

A. External Coatings: Minimum DFT of 25-Mils. (0.025-In.).

B. Internal Coatings: Minimum DFT of 35-Mils.

C. Thickness Determinations: Use Type 1 magnetic thickness gauge as described in SSPC-PA2 specification. Individual readings below 90 percent of specified minimum are not acceptable. Average individual spot readings (consisting of three point measurements within 3-In. of each other) less than 95 percent of minimum are not acceptable. Average of all spot readings less than minimum thickness specified are not acceptable.

3.03 FACTORY APPLICATION OF POLYURETHANE COATING

A. Equipment: Two-component, 1:1 mix ratio, heated airless spray unit.

B. Temperature: Minimum 5 degrees F above dew point temperature. Temperature of surface shall not be less than 60 degrees F during application.

C. Humidity: Heating of pipe surfaces may be required to meet requirements of Paragraph 2.01E, Cured Coating Properties, when relative humidity exceeds 80 percent.

D. Do not thin or mix resins; use as received. Store resins at temperature above 55 degrees F at all times.

E. Application: Conform to coating manufacturer's recommendations. Apply directly to substrate to achieve specified thickness. Multiple-pass, one-coat application process is permitted provided maximum allowable recoat time specified by coating manufacturer is not exceeded.

F. Recoat only when coating has cured less than maximum time specified by coating manufacturer. When coating has cured for more than recoat time, brush-blast or thoroughly sand coating surface. Blow-off cleaning using clean, dry, high pressure compressed air.

G. Cure at ambient temperature above 0 degrees F. Do not handle pipe until coating has been allowed to cure as follows:

AMBIENT TEMPERATURE	MINIMUM FULL CURE TIME
Over 70 degrees F	7 days
50 to 70 degrees F	9 days
0 to 50 degrees F	12 days

3.04 JOINTS

A. Apply coating to unlined pipe surfaces including inside of bell socket and outside of spigot.

B. Coating thickness on sealing areas of spigot end of pipe exterior: Minimum 8-Mils. (0.008-In.), maximum of 10-Mils. (0.010-In.). Maximum 10-Mils. may be exceeded in spigot end provided maximum spigot diameter as specified by pipe manufacturer is not exceeded.

3.05 INSPECTION

A. Public Works may inspect coatings at coating applicator's facilities.

B. Secure approval of surface preparation by coating manufacturer's representative prior to coating application.

C. Holiday Inspection: Conform to AWWA C 210, Section 5.3.3.1. Follow coating manufacturer's recommendation. Conduct inspection any time after coating has reached initial cure. Repair in accordance with

Paragraph 3.07, Repair and Field Touchup.

3.06 PIPE INSTALLATION

A. When required by Public Works, provide services of manufacturer's representative for period of not less than 2 weeks at beginning of actual pipe laying operations to advise Contractor regarding installation including but not limited to handling and storing, cleaning and inspecting, coatings repairs, and general construction methods as to how they may affect pipe coatings.

B. Use nylon straps, padded lifts and padded storage skids. Field cuts should be kept to minimum. Repair damage to coating due to handling or construction practices. See Section 02501 - Ductile - Iron Pipe and Fittings and Section 02502 - Steel Pipe and Fittings for additional requirements.

C. Just before each section of pipe is to be placed into trench, conduct visual and holiday inspection. Repair defects in coating system before pipe is installed.

3.07 REPAIR AND FIELD TOUCHUP

A. Apply repair and touchup materials in conformance with factory application of polyurethane coating requirements specified in this Section, excluding equipment requirements.

B. Repair Procedure - Holidays:

1. Remove traces of oil, grease, dust, dirt, and other deleterious materials

2. Roughen area to be patched by sanding with rough grade sandpaper (40 grit).

3. Apply one coat of repair material described above. Work repair material into scratched surface by brushing.

C. Repair Procedure - Field Cuts or Large Damage:

1. Remove burrs from field cut ends or handling damage and smooth out edge of polyurethane coating.

2. Remove traces of oil, grease, dust, dirt, and other deleterious materials

3. Roughen area to be patched with rough grade sandpaper (40 grit). Feather edges and include overlap of 1-In. to 2-In. of roughened polyurethane in area to be patched.

4. Apply thick coat of repair material described above. Work repair material into scratched surface by brushing. Feather edges of repair material into prepared surface. Cover at least 1-In. of roughened area surrounding damage, or adjacent to field cut.

D. Repair Procedure - Thermite Brazed Connection Bonds:

1. Remove polyurethane coating with power wire brush from area on metal surface which is to receive thermite brazed connection.

2. Grind metal surface to shiny metal with power grinder and coarse grit grinding wheel.

3. Apply thermite-brazed connection using equipment, charge and procedure recommended by manufacturer of thermite equipment.

4. After welded surface has cooled to temperature below 130 degrees F, apply protective coating repair material to weld, exposed pipe surface and damaged areas of polyurethane coating.

5. Do not cover or backfill freshly repaired areas of coating at thermite-brazed connection until repair material has completely cured. Allow material to cure in conformance with manufacturer's recommendations.

END OF SECTION

SECTION 02528

POLYETHYLENE WRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Polyethylene wrap to be used in open-cut construction for cast iron and ductile iron pipe when cathodic protection system is not required by Drawings.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for polyethylene wrap. Include cost of polyethylene wrap in unit price for pipes and fittings to be wrapped.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCE

A. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials For a Wire and Cable.

B. AWWA C 105 - Standard for Polyethylene Encasement for Ductile-Iron Pipe System.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed film and tape for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Polyethylene Film: Tubular or sheet form without tears, breaks,

holidays, or defects; conforming with requirements of AWWA C 105, 2.5 to 3 percent carbon black content, either low- or high-density:

1. Low-density polyethylene film. Low-density polyethylene film shall be manufactured of virgin polyethylene material conforming to following requirements of ASTM D 1248.

   a. Raw material.

      1. Type : I.

      2. Class: C (black).

      3. Grade: E-5.

      4. Flow rate (formerly melt index): 0.4 g/10 minute, maximum.

      5. Dielectric strength: Volume resistivity, 10^{15} ohm-cm, minimum.

   b. Physical properties.

      1. Tensile strength: 1,200 psi, minimum.

      2. Elongation: 300 percent, minimum.

      3. Dielectric strength: 800 V/mil thickness, minimum.

   c. Thickness: Low-density polyethylene film shall have normal thickness of 0.008-In. Minus tolerance on thickness is 10 percent of nominal thickness.

2. High-density, cross-laminated polyethylene film. High-density, cross laminated polyethylene film shall be manufactured of virgin polyethylene material conforming to following requirements of ASTM D 1248

   a. Raw material.

      1. Type: III.

      2. Class: C (black).

      3. Grade: P33.

      4. Flow rate (formerly melt index): 0.4 to 0.5g/10 minute, maximum.

5. Dielectric strength: Volume resistivity, 10^{15} ohm-cm, minimum.

b. Physical properties.

1. Tensile strength: 5000 psi, minimum.

2. Elongation: 100 percent, minimum.

3. Dielectric strength: 800 V/mil thickness, minimum.

c. Thickness: Film shall have nominal thickness of 0.004-In. Minus tolerance of thickness is 10 percent of nominal thickness.

B. Polyethylene Tape: Provide 3-In. wide, plastic-backed, adhesive tape; Paleocene No. 900, Scotchwrap No. 50, or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fit polyethylene film to contour of pipe to affect snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

3.02 INSTALLATION

A. Tubular Type (Method A):

1. Cut polyethylene tube to length approximately 2-Ft. longer than pipe section. Slip tube around pipe, centering tube to provide 1-Ft. overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.

2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points.

4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

B. Tubular Type (Method B):

1. Cut polyethylene tube to length approximately 1-Ft. shorter than pipe section. Slip tube around pipe, centering it to provide 6-In. of bare pipe at each end. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.

2. Before making up joint, slip 3-Ft. length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3-Ft. length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least 1-Ft.; make each end snug and secure.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Sheet Type:

1. Cut polyethylene sheet to length approximately 2-Ft. longer than pipe section. Center length to provide 1-Ft. overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3-Ft..

2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

D. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

E. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

F. Openings in Encasement: Create openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with resulting damaged areas being repaired as specified.

G. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3-Ft. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3-Ft. away from cast or ductile iron pipe.

3.03 REPAIRS

A. Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

END OF SECTION

SECTION 02531

GRAVITY SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for gravity sanitary sewers by open-cut or within Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis, complete in place, including sewer pipe, connections to existing manholes, post installation television inspection and testing. Measurement will be taken along centerline of pipe from centerline to centerline of manholes.

2. Payment for television inspection of existing gravity sanitary sewer will be on a linear foot basis. Measurement will be taken along centerline of pipe from centerline to centerline of manholes. See article 3.09 for cleaning and television inspection procedures.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Video DVDs become property of City.

1.04 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe- to-manhole connections. Perform testing in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers.

B. Regulatory Requirements.

1. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. Install sewer lines to meet minimum separation distance from potable water line per 30 TAC Chapter 217 Rule 217.53.d.

2. Make notification to Public Works when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.

3. Lay gravity sewer lines in straight alignment and grade.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 PRODUCTS

2.01 PIPE

A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.

B. Unlined reinforced concrete pipe is not acceptable.

2.02 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials for mains that conform to requirements:

1. Section 02506 - Polyvinyl Chloride Pipe.

2. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe.

B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.03 APPURTENANCES

A. Stacks. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

B. Service Connections. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.04 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Materials, and Section 02321 - Cement Stabilized Sand.

B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation.

B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.

C. Perform work in accordance with OSHA standards. Employ trench safety system as specified in Section 02260 - Trench Safety System for excavations over 5-Ft. deep.

D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Public Works and

agency or utility company for repairs or relocations, either temporary or permanent.

E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

F. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground Water and Surface Water.

G. Do not allow sand, debris or runoff to enter sewer system.

3.02 DIVERSION PUMPING

A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Public Works.

B. Design piping, joints and accessories to withstand twice maximum system pressure or a minimum 50 psi, whichever is greater.

C. No sewage shall be diverted into area outside of sanitary sewer.

D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Public Works so that required reporting can be made to Texas Commission on Environmental Quality and Environmental Protection Agency by Public Works.

3.03 EXCAVATION

A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Public Works. Maintain this control for minimum of 100-Ft. behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Section 02317 - Excavation and Backfill for Utilities.

3.04 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Public Works.

C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe

G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Public Works.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

J. When possible, install new sanitary sewers no closer to water lines than 9-Ft. in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed per 30 TAC Chapter 217 Rule 217.53.d.

K. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

3.05 PIPE INSTALLATION OTHER THAN OPEN CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to

requirements of specification sections on tunneling augering, jacking and micro-tunneling work as appropriate.

3.06 INSTALLATION OF APPURTENANCES

A. Service Connections. Install service connections to conform to requirements of Section 2534 - Sanitary Sewer Service Stubs or Reconnections.

B. Stacks. Construct stacks to conform to requirements of 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Construct manholes to conform to requirements of Section 02081 - Cast-in-Place Concrete Manholes, Section 02082 - Precast Concrete Manholes, and Section 02083 - Fiberglass Manholes, as applicable. Install frames, rings, and covers to conform to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

3.07 INSPECTION AND TESTING

A. Visual Inspection: Check pipe alignment in accordance with Section 02533 – Acceptance Testing for Sanitary Sewers.

B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Section 02533 - Acceptance Testing for Sanitary Sewers.

C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers. Maintain piezometer installed to conform with Section 01578 - Control of Ground Water and Surface Water, until acceptance testing is completed.

3.08 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Backfill trench in specified lifts only after pipe installation is approved by Public Works.

C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Section 02951 - Pavement Repair and Resurfacing.

D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction

and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4-In. of topsoil as specified in Section 02911 - Topsoil and apply hydromulch according to requirements of Section 02921 - Hydromulch Seeding.

E. Provide sod in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4-In. of topsoil per Section 02911 - Topsoil. Sod disturbed areas in accordance with Section 02922 - Sodding.

3.09 POST-INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.

B. Select and use closed-circuit television equipment that will produce color video DVD. Produce video using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.

C. Perform television inspection of gravity sanitary sewers as follows:

1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.

2. Video DVD shall be continuous for pipe segments between manholes. Do not leave gaps in video recording of segment between manholes and do not show single segment on more than one video DVD.

3. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.

D. Provide video on DVD. Place label on face of each video DVD. Permanently

label each DVD with, at a minimum, the following information.

- Project Name
- Contractor's Name:
- Inspection Type (Pre-Installation or Post-Installation)
- Date Televised:
- Manhole No. From & Manhole No. To

E. For each video provide a completed TV Inspection Report. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter. Items to be listed by footage counter include but are not limited to: service laterals (by position), cracks, misaligned joints, roots, debris, inflow/infiltration, any structural failures of pipe.

F. Upon completion of video reviews by Public Works, Contractor will be notified regarding final acceptance of sewer segment.

END OF SECTION

SECTION 02532

SANITARY SEWER FORCE MAINS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewer force mains.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for installation of force main pipe by open-cut, augered with or without casing, or within limits of Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis. Measurement will be taken along center line of pipe from end to end. Payment will be made for each foot of force main installed, complete in place including pipe, excavation, bedding, backfill and special backfill, shoring, earthwork, connections to existing manholes, acceptance testing, and pipe and accessories.

2. Payment for installation of force main pipe at a stream crossing is on a lump sum basis.

3. The Unit Price item identifies line segments between stations as shown on Drawings.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCE STANDARDS

A. ACI 318 - ACI Building Code and Commentary.

B. ASTM D 696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 C and 30 C with a Vitreous Silica Dilatometer.

C. ASTM D 2310 - Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber- Reinforced- Thermosetting-Resin) Pipe.

D. ASTM D 2992 - Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for “Fiberglass” (Glass-Fiber Reinforced Thermosetting-Resin) Pipe and Fittings.

E. ASTM D 2996 - Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe.

F. Uni-Bell UNI-B-3 Polyvinyl Chloride (PVC) Pressure Pipe (complying with AWWA C 900).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed methods, equipment, materials, and sequence of operations for force main construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Force mains 24-In. in diameter and larger: Submit shop drawings and design calculations for joint restraint systems.

D. Submit qualifications, proposed methods, equipment, materials, and sequence for acceptance testing of pipeline. Submit evidence of experience with pipeline proving by pigging for at least three projects of equal or greater scope; project list shall include dates, size and length of pipe, location, owner name, contact person, and telephone number. Provide certificate of training by manufacturer of pigging equipment being used.

E. Submit test reports as specified in Part 3 of this Section.

PART 2 PRODUCTS

2.01 PIPE FITTING MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of the following Sections:

1. Section 02501 - Ductile-Iron Pipe and Fittings.

2. Section 02505 - High Density Polyethylene Solid and Profile Wall Pipe (HDPE).

3. Section 02506 - Polyvinyl Chloride Pipe. Provide Lined Ductile-Iron Fittings in Accordance with Section 02501 - Ductile-Iron Pipe and Fittings.

B. Pipe and fittings shall be rated for a minimum working pressure of 150 psi.

2.02 THRUST RESTRAINT

A. Unless otherwise shown on Drawings, provide concrete thrust blocking for force mains up to 12-In. in diameter, to prevent movement of buried lines under pressure at bends, tees, caps, valves and hydrants. Blocking shall be Portland cement concrete, as specified in Section 03315 - Concrete for Utility Construction. Place concrete in accordance with details on Drawings. Place thrust blocks between undisturbed ground and fittings. Anchor fittings to thrust blocks so that pipe and fitting joints are accessible for repairs. Concrete shall extend from 6-In. below pipe or fitting to 12-In. above.

B. For force mains larger than 12-In. in diameter, and where indicated on Drawings, provide restrained joints conforming to requirements of force main pipe material specifications. Install restrained joints for length of pipe on both sides of each bend or fitting for full length shown on Drawings.

C. Horizontal and vertical bends between zero and 10 degrees deflection angle will not require thrust blocks or harnessed or restrained joints.

D. Horizontal and vertical bends between 10 degrees and 90 degrees deflection angle shall have thrust restraint as shown on Drawings.

E. Provide thrust restraint at tees, plugs, blow off drains, valves, and caps, as indicated.

F. Reinforced concrete encasement of force main pipe and fittings may be used in lieu of manufactured joint restraint systems. Alternate joint restraint systems using reinforced concrete encasement shall conform to following design requirements.

1. Design calculations shall be performed and sealed by Professional Engineer licensed in State of Texas.

2. Base design calculations upon soil parameters quantified in geotechnical report for site where alternative thrust restraint system is to be installed. When data is not available for site, use parameters recommended by geotechnical engineer.

3. The design system pressure shall be specified test pressure.

4. The following safety factors shall be used in sizing restraint system:

a. Apply factor of safety equal to 1.5 for passive soil resistance.

b. Apply factor of safety equal to 2.0 for soil friction.

5. Contain encasement entirely within standard trench width and terminate on both ends at pipe bell or coupling.

6. Concrete encasement reinforcement steel shall be designed for all loads, including internal pressure and longitudinal forces. Concrete design shall be in accordance with ACI 318.

PART 3 EXECUTION

3.01 PIPE INSTALLATION BY OPEN-CUT

A. Perform excavation, bedding, and backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Wrap ductile-iron pipe and fittings with polyethylene wrap in accordance with requirements of Section 02528 - Polyethylene Wrap. Do not install polyethylene wrap on ductile iron pipe protected by cathodic protection system or fusion bonded or polyurethane coated fittings.

C. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

D. Install pipe only after excavation is completed, bottom of trench is fine graded, bedding material is installed, and trench has been approved by Public Works.

E. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

F. Install pipe with spigot ends toward direction of flow. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

G. Keep interior of pipe clean as installation progresses. Where cleaning after laying pipe is difficult because of small pipe size, use suitable swab or drag in pipe and pull it forward past each joint immediately after joint has been completed. Remove foreign material and debris from pipe.

H. Provide lubricant, place and drive home newly-laid sections with come-a-

long winches so as to eliminate damage to sections. Install pipe to “home” mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Public Works.

I. Keep excavations free of water during construction and until final inspection.

J. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

K. Maintain separation distances per 30 TAC Chapter 217 Rule 217.53.d.

3.02 PIPE INSTALLATION OTHER THAN OPEN-CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification section of augering or tunneling work.

3.03 HYDROSTATIC TESTING

A. After pipe and appurtenance have been installed, test line and drain. Prevent damage to work or adjacent areas. Use clean water to perform tests.

B. Public Works may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards. Test pipe in presence of Public Works.

D. Test pipe at 150 psig or 50 psi over normal operating pressure of force main, whichever is greater. A test must involve filling a force main with water

E. Test pipe at required pressure for minimum of 4 hours according to requirements of 30TAC 217.68. The leakage rate must not exceed 10.0 gallons per inch diameter per mile of pipe per day.

F. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by Public Works.

G. Plug openings in force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

3.04 PIGGING TEST

A. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200-Ft. by pigging to ensure piping is free of obstructions.

B. Pigs: Provide proving pigs manufactured of open-cell polyurethane foam body, without coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of nominal cross-sectional area of pipe. Pigs shall be able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to force main being tested.

C. Test Execution: Conduct pigging test in presence of Public Works. Provide at least 48-hours notice of scheduled pigging of force main prior to commencing test.

END OF SECTION

SECTION 02533

ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acceptance testing of sanitary sewers including:

1. Visual inspection of sewer pipes

2. Mandrel testing for flexible sewer pipes.

3. Leakage testing of sewer pipes.

4. Leakage testing of manholes.

5. Smoke testing of point repairs.

B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for acceptance testing under this Section. Include payment in unit price for work requiring acceptance testing.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

B. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity

Sewer Pipe and Fittings Based on Controlled Inside Diameter.

D. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

1.04 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.

B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. Perform air testing in accordance with requirements of this Section and Texas Commission on Environmental Quality requirements. Refer to Table 02533-1, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig.

D. Televised inspection of constructed gravity sewer line.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Public Works. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.06 GRAVITY SANITARY SEWER QUALITY ASSURANCE

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.

B. Provide testing reports and video tape of television inspection as directed by Public Works.

C. Upon completion of tape reviews by Public Works, Contractor will be notified regarding final acceptance of sewer segment.

1.07 SEQUENCING AND SCHEDULING

A. Perform testing as work progresses. Schedule testing so that no more than 1000-Ft. of installed sewer remains untested at one time.

B. Coordinate testing schedules with Public Works. Perform testing under observation of Public Works.

PART 2 PRODUCTS

2.01 DEFLECTION MANDREL

A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, or average ID of a pipe, as specified in the appropriate standard by the ASTMs, American Water Works Association, UNI-BELL, or American National Standards Institute, or any related appendix.

B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more odd number of "runners" or "legs". Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Adjustable or flexible mandrel is prohibited. Provide and use proving ring for modifying each size mandrel.

C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-In. thick, 3-In. wide bar steel to diameter 0.02-In. larger than approved mandrel diameter.

D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 02533-3, Pipe vs. Mandrel Diameter, at end of this Section and as shown on the City of Schertz Standard Detail. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Public Works.

2.02 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:

1. Control panel

2. Low-pressure air supply connected to control panel.

3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested;

capable of withstanding internal test pressure without leaking or requiring external bracing.

4. Air hoses from control panel to:

a. Air supply.

b. Pneumatic plugs.

c. Sealed line for pressuring.

d. Sealed line for monitoring internal pressure.

B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

2.03 SMOKE TESTING

A. Equipment:

1. Pneumatic plugs.

2. Smoke generator as supplied by Superior Signal Company, or approved equal.

3. Blowers producing 2500 scfm minimum.

PART 3 EXECUTION

3.01 PREPARATION

A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.

B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 01578 - Control of Ground Water and Surface Water.

3.02 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

A. Check pipe alignment visually by flashing light between structures. Verify if

alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re- lay or replace pipe segment.

B After testing and prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection per Section 02531.

3.03 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.

B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.

C. Re-test repaired or replaced sewer sections.

3.04 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

A. Test gravity sanitary sewer pipes for leakage by Low Pressure air testing. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.

B. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 02533-1.

1. Air testing for sections of pipe shall be limited to lines less than 36-In. average inside diameter.

2. Lines 33-In. average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.

3. For pipe sections less than 33-In. average inside diameter:

a. Determine ground water level.

b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.

c. After manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.

d. Pressurize pipe to 4.0 psi or 3.5 psi greater than the pressure exerted by ground water above the pipe. Bleed back pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 02533-1 at end of this Section.

e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 02533-1 at end of this Section for pipe diameter and length. For slip-lining, use diameter of carrier pipe. A minimum of five (5) readings will be required for each test.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.05 LEAKAGE TESTING FOR MANHOLES

A. After completion of manhole construction and backfilling, test manholes for water tightness using vacuum testing procedures.

B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6-In. outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

C. Vacuum testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.

2. Evacuate manhole with vacuum pump to 10-In. mercury (Hg), disconnect pump, and monitor vacuum for 2 minutes, per 30 TAC Chapter 217 Rule 217.58.

3. If drop in vacuum exceeds 1-In. Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are

obtained.

3.06 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.

2. Determine when point repairs are properly made.

3. Determine when service connections have been reconnected to rehabilitated sewer.

4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to City of Schertz Police and Fire Departments 24 hours prior to actual smoke testing.

D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for slip-lined sections.

E. Smoke Introduction:

1. Operate equipment according to manufacturer's recommendation and as approved by Public Works.

2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.

3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work

day, properly barricade and cover each excavation as approved by Public Works.

G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

Table 02533-1. ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG			
Pipe Dia. (in)	**Min. Time (min:sec)**	**Length for Min. Time (ft)**	**Time for Longer Length (sec/ft)**
6	5:40	398	0.8548
8	7:33	298	1.5196
10	9:27	239	2.3743
12	11:20	199	3.4190
15	14:10	159	5.3423
18	17:00	133	7.6928
21	19:50	114	10.4708
24	22:40	99	13.6762
27	25:30	88	17.3089
30	28:20	80	21.3690
33	31:10	72	25.8565

Table 02533-2. Pipe vs. Mandrel Diameter

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches)	Minimum Diameter (Inches)
PVC-Solid (SDR 26)6	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)12	12	11.737	11.15
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.12
	27	26.351	25.033
PVC-Truss	8	7.75	7.363
	10	9.75	9.263
	12	11.79	11.201
	15	14.77	14.032
PVC-Profile (ASTM F 794)	12	11.74	11.153
	15	14.37	13.652
	18	17.65	16.768
	21	20.75	19.713
	24	23.5	22.325
	27	26.5	25.175
	30	29.5	28.025
	36	35.5	33.725
	42	41.5	39.425
	48	47.5	45.125
HDPE-Profile	18	18	17.1
	21	21	19.95
	24	24	22.8
	27	27	25.65
	30	30	28.5
	36	36	34.2
	42	42	39.9
	48	48	45.6
	54	54	51.3
	60	60	57

END OF SECTION

SECTION 02534

SANITARY SEWER SERVICE STUBS OR RECONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of service stubs in sanitary sewers serving areas where sanitary sewer service did not previously exist.

B. Reconnection of existing service connections along parallel, replacement, or rehabilitated sanitary sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for sanitary sewer service stubs or service reconnections with stacks located within 5-Ft. of sanitary sewer main centerline is on unit price basis for each stub or reconnection. Payment will be made for each service stub or reconnection installed complete in place, including service connections, couplings, and adapters disconnecting existing services, reconnecting new service, fittings, excavation, and backfill.

2. Payment for sanitary sewer service stubs or service reconnections without stacks located within 5-Ft. of sanitary sewer main is on unit price basis for each stub or reconnection. Payment will be made for each service stub or reconnection installed complete in place, including service connections, couplings, and adapters disconnecting existing services, reconnecting new service, fittings, excavation, backfill and testing.

3. Payment for sanitary sewer service lines more than 5-Ft. laterally from sewer main is on linear foot basis. Measurement will be taken along centerline of pipe from centerline of lateral connection or stack to end of service for service stubs laid in open-cut excavation. Payment will be made for each linear foot of pipe installed, complete in place, including sewer pipe, excavation, shoring, bedding, backfill, and accessories in addition to payment for sewer stubs or service connections with or without stacks. Augered pipe for service stubs will be paid as provided in Section 02448 - Pipe and Casing Augering.

4. Pay estimates for progress payments will be made as

measured above according to following schedule:

a. An estimate for 95 percent payment will be authorized when reconnection is completely installed and backfilled.

b. An estimate for 100 percent payment will be authorized when reconnection has been tested as specified in Section 02732 - Acceptance Testing for Sanitary Sewers.

5. One or more connections discharging into common point are considered one service connection. Contractor shall not add service reconnections without approval of Public Works. Public Works may require connections to be relocated to avoid having more than two service connections per reconnection.

6. Protruding service connections which must be removed to allow liner insertion are paid as service reconnection when connected. If abandoned, they will be paid as abandoned connection.

7. Payment for abandonment of service connection is on unit price basis for each abandoned connection. No separate payment will be made for abandonment of service connection unless excavation is required. No separate payment will be made for excavation of sanitary sewer services within new or replacement sewer trench.

8. No separate payment will be made for removal of existing sanitary sewer service stubs. Include payment in unit price for Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

9. No separate payment will be made for abandoned service connection when service to be abandoned is within 4-Ft. of active connection. Payment for only one abandoned service connection will be allowed when second abandoned connection is within 4-Ft. of first.

10. If faulty remote cut is later corrected using procedures specified for reconnection by excavation, only one reconnection will be allowed for payment.

11. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

B. ASTM D 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

1.04 PERFORMANCE REQUIREMENTS

A. Accurately locate in field all proposed service stubs along new sanitary sewer main.

B. Accurately locate in field existing service connections and proposed service stubs along alignment of new parallel or replacement sewer main.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for each pipe product, fitting, coupling and adapter.

C. Show reconnected services on record drawings. Give exact distance from each service connection to nearest downstream manhole.

PART 2 PRODUCTS

2.01 PVC SERVICE CONNECTION

A. As stub outs, use PVC sewer pipe of 6-In. through 10-In. diameter, conforming to ASTM D 1784 and ASTM D 3034, with cell classification of 12454-B. SDR (ratio of diameter to wall thickness) shall be 26 for pipe 10-In. in diameter or less.

B. PVC pipe shall be gasket jointed with gasket conforming to ASTM D 3212.

C. Provide service connection pipe in sizes shown on Drawings. For reconnection of existing services, select service connection pipe diameter to match existing service diameter.

D. Connect service pipes to parallel or replacement sewer mains with prefabricated, full-bodied tee or wye fittings conforming to

specifications for sewer main pipe material as specified in other Sections for sewers up to 18-In. in diameter.

E. Where sewers are installed using pipe augering or tunneling, or where sewer is greater than 18-In. in diameter, use Fowler "Inserta-Tee" to connect service to sewer main.

2.02 PIPE SADDLES

A. Use pipe saddles only on rehabilitated sanitary sewer mains. Comply with Paragraph 2.01E for new parallel and replacement sanitary sewer mains.

B. Supply one-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket to accomplish complete seal. Use saddle fabricated to fit outside diameter of connecting pipe. Protruding lip of saddle must be at least 5/8-In. long with grooves or ridges to retain stainless steel band clamps.

C. Use 1/2-In. stainless steel band clamps for securing saddles to liner pipe.

2.03 COUPLINGS AND ADAPTERS

A. For connections between new PVC pipe stubouts and existing service, 4-, 6-, or 8-In. diameter, use flexible adapter coupling consisting of neoprene gasket and stainless steel shear rings with 1/2-In. stainless steel band clamps:

1. Fernco Pipe Connectors, Inc. Series 1055 with shear ring SR-8

2. Band Seal by Mission Rubber Co., Inc.

3. Approved equal.

B. For connections between new PVC pipe stubout and new service, use rubber-gasket adapter coupling:

1. GPK Products, Inc.

2. IPS & Sewer Adapter

3. Approved equal.

2.04 STACKS

A. Provide stacks for service connections wherever crown of sewer is 8-Ft. or more below finished grade.

B. Construct stacks of same material as sanitary sewer and as shown on Drawings.

C. Provide stacks of same nominal diameter at sanitary service line.

2.05 PLUGS AND CAPS

A. Seal upstream end of unconnected sewer service stubs with rubber gasket plugs or caps of same pipe type and size. Provide plugs or caps by GPK Products, Inc. or approved equal.

PART 3 EXECUTION

3.01 PERFORMANCE REQUIREMENTS

A. Provide minimum of 72 hours notice to customers whose sanitary sewer service will potentially be interrupted.

B. Accurately field locate service connections, whether in service or not, along rehabilitated sanitary sewer main. For parallel and replacement sewers, service connections may be located as pipe laying progresses from downstream to upstream.

C. Properly disconnect existing connections from sewer and reconnect to rehabilitated liner, as described in this Section.

D. Reconnect service connections, including those that go to unoccupied or abandoned buildings or to vacant lots, unless directed otherwise by Public Works.

E. Complete reconnection of service lines within 24 hours after cured-in-place liner installation and within 72 hours after disconnection for sliplining, parallel, or replacement sanitary sewer mains.

F. Reconnect services on cured-in-place liner at 12-Ft. depth or less by excavation method. Public Works reserves the right to require service connections by excavation when remote cut service connection damages lines.

G. Reconnection by excavation method shall include stack and fittings and required pipe length to reconnect service line.

H. Connect services 8-In. in diameter and larger to sewer by construction of manhole. Refer to appropriate Section on manholes for construction and payment.

3.02 PROTECTION

A. Provide barricades, warning lights, and signs for excavations created for service connections. Conform to requirements of Section 01504 - Temporary Facilities and Controls.

B. Do not allow sand, debris, or runoff to enter sewer system.

3.03 PREPARATION

A. Determine existing sewer locations and number of existing service connections from closed- circuit television (CCTV) inspection tapes or from field survey. Accurately field locate existing service connections, whether in service or not. Use existing service locations to connect or reconnect service lines or liner.

B. For rehabilitated sanitary sewer mains, allow liner to normalize to ambient temperature and recover from imposed stretch. For cured-in-place liners, verify that liner is completely cured.

C. For new parallel and replacement sanitary sewer mains, complete testing and acceptance of downstream sewers as applicable. Provide for compliance with requirements of Paragraph 3.01E.

3.04 EXCAVATION AND BACKFILL

A. Excavate in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Perform work in accordance with OSHA standards. Employ Trench Safety System as specified in Section 02260 - Trench Safety System for excavations requiring trench safety.

C. Install and operate necessary ground water and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

D. Determine locations where limited access, buildings or structure preclude use of mechanical excavation equipment. Obtain approval from Public Works for hand excavation.

3.05 RECONNECTION BY EXCAVATION METHOD

A. Remove portion of existing sanitary sewer main or carrier pipe to expose liner pipe. Provide sufficient working space for installing prefabricated pipe saddle.

B. Carefully cut liner pipe making hole to accept stubout protruding from underside of saddle.

C. Strap on saddle using stainless steel band on each side of saddle. Tighten bands to produce watertight seal of saddle gasket to liner pipe.

D. Remove and replace cracked, offset, or leaking service line for up to 5-Ft., measured horizontally, from center of new liner.

E. Make up connection between liner and service line using PVC sewer pipe and approved fittings and couplings.

F. Encase entire service connection in cement stabilized sand as shown on Drawings.

G. Test service connections before backfilling.

3.06 RECONNECTION BY REMOTE METHOD

A. Make service reconnections using remote-operated cutting tools on cured-in-place liners at depth greater than 12-Ft..

B. Employ method and equipment that restore service connection capacity to not less than 90 percent of original capacity.

C. Immediately open missed connections and repair holes drilled in error using method approved by Public Works.

3.07 RECONNECTION ON PARALLEL OR REPLACEMENT SEGMENTS

A. Install service connections on sewer main.

B. Remove and replace cracked, offset or leaking service line for up to 5-Ft., measured horizontally, from centerline of sanitary sewer main.

C. Make up connection between main and existing service line using PVC sewer pipe and approved couplings, as shown on Drawings.

D. Test service connections before backfilling.

E. Embed service connection and service line as specified for sanitary sewer main as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities.

3.08 INSTALLATION OF NEW SERVICE STUBS

A. Install service connections on sanitary sewer main for each service connection. Provide length of stub indicated on Drawings. Install plug or cap on upstream end of service stub as needed.

B. Test service connections before backfilling.

C. Embed service connection and service line as specified for sanitary sewer main, and as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities. Install minimum 2-Ft. length of magnetic locating tape along axis of service stub and 9-In. to 12-In. above crown of pipe, at end of stub.

3.09 TESTING

A. Test service reconnections and service stubs. Follow applicable procedures given in Section 02533 - Acceptance Testing for Sanitary Sewers to perform smoke testing to confirm reconnection.

B. Perform post installation CCTV inspection as specified in Section 02531 to show locations of service connection.

3.10 CLEANUP

A. Backfill excavation as specified in Section 02317 - Excavation and Backfill for Utilities.

B. Replace pavement or sidewalks removed or damaged by excavation in accordance with Section 02951 - Pavement Repair and Resurfacing. In unpaved areas, bring surface to grade and slope surrounding excavation. Replace minimum of 4-In. of topsoil and seed according to requirements of Section 02921 - Hydro-mulch Seeding.

END OF SECTION

SECTION 02571

PIPE BURSTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section specifies the system, method, or process to include all labor materials, tools, equipment and incidentals necessary to provide for the complete rehabilitation/replacement of deteriorated pipe by the Pipe Bursting System.

1.02 UNIT PRICES

A. Measurement for installing replacement pipe using pipe bursting method is on a linear foot basis for installed liner pipe, measured from center line of upstream manhole to center line of downstream manhole. Depth range for payment is based on greatest depth measured at manholes from natural ground level to flow line of sanitary sewer for each pipeline segment.

B. Insertion or access pits, clamp installation, embedment (bedding, haunching and initial backfill), field quality control (testing), sealing liner at manholes, grouting annular space, building up, shaping and reworking manhole inverts and benches, and pre-installation and post-installation cleaning and television inspection of completed work are included in pipe bursting unit price and not paid for separately.

D. Point repair of sanitary sewer for pipe replacement, digging a sag elimination pit, and bringing the bottom of the pipe trench to a uniform grade in line with existing pipe invert or by other measures that shall be acceptable to the Owner. Payment shall be per linear foot and to include site restoration.

C. Locating and reconstruction of services and all connections of services will be paid for per each connection made, including fittings and pipe.

D. The cost of any necessary bypass pumping will be considered subsidiary to the appropriate pay items for pipe installation, or related work and will not be a separate pay item

E. Refer to Section 01270 - Measurement and Payment, for unit price procedures.

1.03 REFERENCES:

A. A STM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.

B. ASTM D 2122 - Determining Dimensions of Thermoplastic Pipe and Fittings.

C. ASTM D 2412 - Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

D. ASTM D 2992 - Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting- Resin) Pipe and Fittings.

E. ASTM D 3262 - "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

F. ASTM D 3350 - Polyethylene Plastics Pipe and Fittings Materials.

G. ASTM D 3681 - Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition.

H. ASTM D 4161 - "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

1.04 DEFINITIONS

A. Pipe bursting: Reconstruction of sanitary sewers by insertion of liner pipe within the bore of the existing pipe, enlarged by breaking and expanding the old pipe.

1.05 SYSTEM DESCRIPTION

A. Pipe bursting involves rehabilitation of deteriorated gravity sewer pipe by installing new pipe material within the enlarged bore created by using a static, hydraulic, or pneumatic hammer “moling” device, suitably sized, to break old pipe, or by using a modified boring “knife” with a flared plug that crushes existing sewer pipe. Forward progress of the “mole” or “knife” may be aided by hydraulic equipment or other apparatus. Replacement pipe is either pulled or pushed into the bore.

1.06 QUALITY ASSURANCE

A. The Contractor shall provide qualifications to the representative upon request evidence of competency and authority to perform pipe bursting.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prevent injury to or abrasion of pipe during loading, transportation and unloading. Do not drop pipe from vehicles, nor allow pipe to roll down skids or slopes without proper restraining ropes. Use suitable pads, strips, skids or blocks for each pipe during transportation and while awaiting installation.

B. Do not use, and remove from construction site, pipe with physical damage such as cuts, gashes, nicks or abrasions which may have occurred during shipping, storage, or handling, which are deeper than 10 percent of wall thickness.

C. Use wide belly band slings for lifting and moving pipe. Do not use bare chains in contact with pipe.

1.08 PERFORMANCE REQUIREMENTS

A. Maintain sewage flow by diversion pumping or other method approved by the Engineer.

B. Clear existing sewers of debris, obstructions and other foreign material, point repair of damaged or sagging sewer.

C. Perform pipe bursting according to this Section.

D. Shape manhole inverts as specified in Section 02081 – Cast-In-Place Manhole.

E. Test lines as specified in Section 02533 - Acceptance Testing for Sanitary Sewers.

F. Inspect lines by video inspection as specified in Section 02531-Gravity Sanitary Sewers.

1.09 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures, and Section 01340 - Shop Drawings, Product Data and Samples.

B. Submit to City a pipe bursting plans which shall minimally included pit locations and schedule, service line replacement, bursting distances and directions, and service outage and reinstatement schedule.

C. Submit manufacturer's product data with complete information on pipeline materials including physical properties and dimensions pertinent to this job. Furnish certificates of compliance with specifications for materials to be supplied.

D. Submit independent testing laboratory test reports certifying that polyethylene pipe conforms to ASTM D 1248 and ASTM D 3350, that fiberglass reinforced plastic (FRP) pipe conforms to ASTM D 3262 and ASTM D 3681, as applicable.

E. Submit manufacturer’s product data on clamps.

F. Submit video inspection as specified in Document 02558 - Cleaning and Television Inspection.

1.10 TESTING

A. City may have tests performed on field samples by an independent laboratory following applicable ASTM specifications to verify physical properties and characteristics of supplied materials. Provide product samples as requested by Engineer.

B. City will pay for tests on materials which meet specification requirements. Contractor shall pay for failed tests and consequent retesting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Liner pipe systems shall be polyethylene or fiberglass reinforced plastic (FRP) products approved by the City.

B. Approved manufacturers for polyethylene liner: Chevron and Phillips.

C. Approved manufacturer for FRP liner: Hobas USA, Inc.

2.02 POLYETHYLENE PIPE AND FITTINGS

A. Provide polyethylene liner pipe, manufactured of solid-wall, high-density, high-molecularweight polyethylene meeting ASTM D 1248, Type III, Class B, Grade P-34, Category 5, with a PPI rating of PE 3408. Use polyethylene material with a minimum cell classification of 345434D or E (inner wall of light color) under ASTM D3350. Higher-numbered cell classification limits yielding desirably higher primary properties, according to ASTM D 3350, are also acceptable. Dimensions and workmanship: Meet ASTM F 714 and ASTM D 2122.

B. Provide pipe with maximum Standard Dimension Ratio (SDR), and ratio of outside pipe diameter to wall thickness, as specified in Section 02505 High Density Polyethylene Pipe. Select SDR for the deeper of two manholes in each particular pipeline segment.

C. Fittings for pressure systems shall be ductile iron with a minimum working pressure rating of 200 psi using HDPE MJ adapters to transition from the HDPE pipe to the fitting. At locations were bends are required pre-cast thrust blocks shall be installed.

D. Stainless steel stiffener inserts, ASTM 240, shall be used for all fittings and connections to HDPE pipe. Stiffeners shall be of SS 304, wedge-type design.

2.03 LINER PIPE SEAL AT MANHOLES

A. Sealer for annular space between liner pipes and manhole: Oakum strips soaked in Scotchseal 5600 as manufactured by 3M Corporation, or approved equal.

B. Non-Shrink Grout: Strong Seal’s QSR patching material, or approved equal.

2.04 CLAMPS AND GASKETS

A. Clamps: Stainless steel, including bolts and lugs; Type 108, as manufactured by JCM Industries or equal. Furnish full circle, universal clamp couplings with at least 3/16-inch thick neoprene grid-type gaskets. Select clamps to fit outside diameter of liner pipe as follows:

Liner Pipe Outside Diameter (Inches)	**Minimum Clamp Length (Inches)**
8.625	18
10.750 or greater	30

2.05 SERVICE CONNECTIONS

A. The service connection shall be specifically designed for connection to the HDPE sewer main being installed, and shall be INSERTA TEE, as

manufactured by Insert Tee Fittings, Inc., Hillsboro, Oregon, or an approved equal.

2.06 BEDDING MATERIAL

A. Bedding: Comply with Section 02320 - Utility Backfill Materials.

PART 3 EXECUTION

3.01 OBSTRUCTION REMOVAL AND POINT REPAIR

A. Make point repairs and remove obstructions, such as roots, rocks and other debris, prior to installing liner pipe. Remove and dispose of debris in accordance with Section 01504 - Temporary Facilities and Controls, or Section 01576 - Waste Material Disposal.

B. If pre-installation video inspection reveals a sag in the existing sewer that is greater than one-half the diameter of the existing pipe, it shall be the Contractor's responsibility to install the replacement pipe to the result in an acceptable grade without the sag. The Contractor shall take in necessary measures to eliminate these sags, as directed by the City.

3.02 DIVERSION PUMPING

A. Refer to Section 01540 - Diversion Pumping.

3.03 INSERTION OR ACCESS PITS

A. Locate pits so that total number is minimized and footage of liner pipe installed in a single pull is maximized. Where possible, use excavations at point repair locations for insertion pits.

B. Prior to excavation, the Contractor shall check with all utility providers and determine locations of utilities in or near the work area. Costs of utility repairs, temporary service and other costs arising out of damage to or interruption of utilities resulting from operations under this contract shall be borne by Contractor at no additional cost to the City.

C. Perform excavation and backfill in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.

D. Perform work in accordance with OSHA standards. Comply with Section 02260 - Trench Safety System for excavations requiring trench safety.

E. Install and operate necessary dewatering and surface water control measures in accordance with Section 01578 - Control of Ground and Surface Water.

3.04 REMOVAL OR CUTTING OF PLASTIC PIPE TO ALLOW FOR PIPE BURSTING OF THE SEWER

A. If a pipe that is scheduled to receive rehabilitation is found to have received sliplining or pipe bursting on a previous occasion, the Contractor shall notify the Engineer immediately. The Engineer may direct the Contractor to clean and televise the line segment and/or cut or remove the

existing liner in conjunction with the installation of a new pipe via pipe bursting. Removal or cutting of the existing liner shall be performed upon approval and notification from the Engineer.

B. The Contractor shall provide the means, method, equipment and labor to cut or remove the plastic pipe to allow for the successful pipe bursting of the sewer.

1. The means or method utilized by the Contractor shall not disturb the surrounding soil or host pipe to the degree where it will effect the installation and operation of the new pipe to be installed.

2. Cutting of the liner or removal of the existing liner shall not interfere or damage the connections beyond the extent required to disconnect and reconnect the service laterals to the main line.

3. Removal of the existing liner will only be allowed if cutting is not possible.

4. Liner cutting or removal shall be considered complete when the existing pipe has been cut or removed and the new pipe has been successfully installed and accepted.

C. During the liner removal or cutting effort the Contractor may encounter conditions that inhibit pipe removal or the cutting of the pipe. These include, but are not limited to obstructions, couplings, pipe clamps, or cement stabilized sand. When these conditions stop the advancement of the head, the Contractor shall request approval for an obstruction removal from the Engineer. Once approved, the Contractor shall perform all work necessary to remove the obstruction and allow for the resumption of progress of the liner removal or cutting effort.

D. Line segments with existing conditions that prevent the successful removal or cutting of the liner pipe by conventional methods shall be evaluated on a case by case basis.

3.05 PIPE BURSTING

A. Pipe bursting shall be accomplished using the hydraulic method. In general, the bursting operation shall be as follows

1. Post notices of service interruption and outages as indicated in the pipe-bursting plan.

2. Isolate the existing system and excavate launch, bursting, and service pipes as indicated in the pipe-bursting plan.

3. Construct placement service lines.

4. Set up the bursting equipment in the bursting pit and insert the bursting rods or cable through the host pipe.

5. Connect the bursting head to the main and the bursting rods or cable in the launch pit.

6. Burst the existing main.

7. Install new service connection fittings and connect new service lines.

8. Flush the new main then connect the new main to the existing system; and

9. Continue this series of operation to complete the full scope of burstings.

B. Joints:

1. Assemble and join sections of polyethylene liner pipe on site, above ground. Make joints by heating and butt-fusion method in strict conformance to manufacturer's instructions and Section 02505.

2. Use operators who are experienced with butt-fusion jointing of pipe. Operators shall be trained infusing polyethylene pipe with similar equipment using proper jigs and tools in accordance with pipe manufacturer’s standard procedures.

3. Form joints with smooth, uniform double-rolled back beads made while applying proper melt, pressure and alignment. Joints must be inspected and approved by the Engineer before insertion.

B. Preparation: After completing insertion pit excavation, remove top of existing sanitary sewer line down to the spring line. Connect power winch cable to end of liner by use of suitable pulling head equal to outside diameter of liner. Secure pulling head to liner and attach to power winch cable so that liner can be satisfactorily fed and pulled through sanitary sewer line. Prevent ragged edges of existing pipe from scarring liner pipe. Follow insertion procedures in ASTM F 585. Do not allow sand or other debris to enter liner.

C. Pulling Liner:

1. Maximum length of continuous liner assembled above ground and pulled at any one time: Do not exceed length recommended by manufacturer's printed instructions.

2. Limit pulling force exerted on liner to that indicated below for the appropriate outside diameter of the polyethylene liner. Provide a suitable pulling force measuring device connected to the winch or pulling mechanism.

Polyethylene Liner O.D. (Inches) 8.625	**Maximum Pulling Force (Tons) 4.0**
10.75	7.5
14.0	10.5
16.0	12.0
18.0	21.5

D. Alternate Insertion Techniques: Pushing, or a combination of pulling and pushing, may be used subject to the Engineer's approval. Avoid liner buckling or dimpling by limiting stroke of pushing implement. Cut out and remove portions damaged during insertion process.

3.06 CLAMP INSTALLATION

A. Where excavations for liner pipe insertion are made between two manholes, cut ends of liner pipe smooth, square to pipe axis. Join liner pipes with appropriately-sized stainless steel universal clamp couplings. Butt together gaps between ends of liner pipe with space between ends not exceeding one inch.

B. Bedding: Install cement-stabilized sand bedding in accordance with Section 02321 - Cement Stabilized Sand. Extend bedding 12 inches above clamp/liner pipe.

3.07 FIELD QUALITY CONTROL

A. After liner installation, perform the following tests:

1. Low pressure air test: Perform before sealing liner in place at manholes, and before making service reconnections to liner. Check integrity of joints made, and verify that liner has not been damaged.

2. Service lateral connection test: After all service laterals have been completed for a particular sewer section, verify integrity of re-connections at points where they join liners and existing service lines by performing smoke test.

3. Refer to Section 02533-Acceptance Testing for Sanitary Sewers for applicable test procedures.

3.08 SEALING LINER IN MANHOLES

A. Allow liner pipe to normalize to ambient temperatures and recover from imposed stretch before cutting to fit between manholes, sealing at manholes, and shaping manhole inverts. Allow at least 12 hours for normalization of polyethylene liners.

B. Cut liner so it extends 4 inches into manholes. Make smooth, vertical cuts and slope areas over top of exposed liner using non-shrink grout.

C. Seal annular spaces between liner at each manhole with specified chemical liner pipe seal and non-shrink grout. Place strips of oakum soaked in sealer in a band to form an effective watertight gasket in the annular space between liner and existing pipes in manhole. Make width of the sealing band at least 8 inches.

D. Finish seal liner pipe to host pipe with non-shrink grout placed around annular space from inside manhole. Apply grout in a band at least 6 inches wide.

E. Reshape and smooth manhole inverts as specified in Section 02555 – Manhole Rehabilitation. Use approved manhole rehabilitation material to form smooth transitions with reshaped inverts and raised manhole benches to eliminate sharp edges of liner pipe, concrete benches and channeled inverts. Build up and smooth manhole inverts to match flow line of new liner.

3.09 POST-INSTALLATION VIDEOTAPE INSPECTION OF COMPLETED WORK

A. Provide the Engineer with video inspection showing completed work including condition of restored connections. Comply with Document 02533 - Acceptance Testing for Sanitary Sewers.

3.10 FINAL CLEANUP

A. Upon completion of installation, testing and inspection, clean and restore project area affected by work of this Section. Restore site in accordance with Section 01740 - Restoration of Site Improvements.

END OF SECTION

SECTION 02611

REINFORCED CONCRETE PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforced concrete pipe for sanitary sewers and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for reinforced concrete pipe under this Section. Include cost in unit price work as specified in following Sections:

a. Section 02531 - Gravity Sanitary Sewers.

b. Section 02631 - Storm Sewers.

2. Refer to Section 01270- Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.

C. ASTM C 497 - Standard Test Method for Concrete Pipe, Manhole Sections, or Tile.

D. ASTM C 506 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe

E. ASTM C 655 - Standard Specification for Reinforced Concrete D-load Culvert, Storm Drain and Sewer Pipe.

F. ASTM C 877 - Standard Specification for External Sealing Bands for

Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit complete product data for pipe, fittings and gaskets for approval. Indicate conformance to appropriate reference standards.

C. Submit manufacturer's certificate that concrete pipes meet applicable standards.

D. For jacking pipe, submit drawings and data describing grouting port design and closure procedures when required by Section 02431 - Tunnel Grout, including liner repair, as applicable.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Conform circular reinforced concrete pipe to requirements of ASTM C 76 or C 655, for Class III wall "B" thickness. Conform to rubber gasket joints for sanitary sewers and storm sewers and tongue and groove for roadside ditch culverts to ASTM C 443.

B. Conform reinforced concrete arch pipe to requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.

C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Use rubber gasket joints conforming to ASTM C 877.

D. Conform reinforced concrete D-load pipe requirements of ASTM C 655.

2.02 GASKETS

A. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM C 877 for reinforced concrete elliptical pipe.

B. Use the following gasket materials for pipes to be installed in potentially contaminated areas, especially where free product is found near elevation of proposed sewer:

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by pipe manufacturer

2.03 LINERS FOR SANITARY SEWER PIPE

A. Reinforced concrete pipe for sanitary sewers shall be PVC lined and conform to Section 02427 - Plastic Liner for Large Diameter Concrete Sewers and Structures.

B. Reinforced concrete pipes to be installed in potentially contaminated areas shall have liners recommended by manufacturer as resistant to contaminants identified in Phase II Environmental Site Assessment Report.

2.04 SOURCE QUALITY CONTROL

A. Representatives of City Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to requirements of following Sections, as applicable:

1. Section 02448 - Pipe and Casing Augering for Sewers.

2. Section 02531 - Gravity Sanitary Sewers.

3. Section 02631 - Storm Sewers.

B. Install reinforced concrete pipe in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 02612

PRECAST REINFORCED CONCRETE BOX SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast reinforced concrete box sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for precast reinforced concrete box sewer under this Section. Include payment in unit price for Sections 02631 - Storm Sewers.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 1433 – Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings and data on box sections, fittings, gaskets, and appurtenances for approval. Indicate conformance to reference standards.

PART 2 PRODUCTS

2.01 PRECAST REINFORCED CONCRETE BOX SEWERS

A. Conform to ASTM C 1433, as indicated on Drawings.

B. Pipe and boxes shall be machine-made or cast by process which will provide for uniform placement of concrete in forms and compaction by mechanical devices to produce dense, structurally sound concrete.

2.02 CONCRETE

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

B. Use concrete mixed in central batch plant or other batching facility from which quality and uniformity of concrete can be assured. Transit-mixed concrete is not acceptable.

2.03 SOURCE QUALITY CONTROL

A. Representatives of City Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3 EXECUTION

3.01 BEDDING

A. Bed box sections on foundation of firm and stable material accurately shaped to conform to their bases. Install bedding as specified in Section 02317 - Excavation and Backfill for Utilities. When required by Drawings, use special bedding material. When single-cell box sections are placed in parallel for multi-cell installation, place in conformance with details shown on Drawings.

3.02 PLACEMENT

A. Carefully lower box sections to bottom of trench and lay accurately in line and grade, with spigot or tongue end downstream entering bell or groove end to full depth and in such manner as not to drag foreign material into annular space.

3.03 JOINTING

A. Join box sections together and match so that they will form continuous smooth and uniform invert.

3.04 BACKFILLING

A. After box has been properly jointed and bedded, commence backfilling.

B. Backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION

SECTION 02621

GEOTEXTILE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Geotextile, also called filter fabric, in applications including pipe embedment wrap, around exterior of tunnel liner, around foundations of pipeline structures, and slope stabilization.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for Work performed under this Section. Include cost of work in unit prices for work requiring geotextile.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO M 288 - Standard Specification for Geotextile Specification for Highway Applications.

B. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

C. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

D. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles (Grab Method).

E. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of Geotextiles.

F. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit standard manufacturer's catalog sheets and other pertinent information, for approval, prior to installation.

C. Submit installation methods, as part of work plan for tunneling or for excavation and backfill for utilities. Obtain approval from Public Works for filter fabric material and proposed installation method prior to use of filter fabric.

PART 2 PRODUCTS

2.01 GEOTEXTILE

A. Provide geotextile (filter fabric) designed for use in geotechnical applications. Filter fabric shall provide permeable layer or media while retaining soil matrix.

B. Use fabric which meets physical requirements for Class A subsurface drainage installation conditions as defined in AASHTO M 288 and as specified in Paragraph 2.02, Properties.

2.02 PROPERTIES

A. Material: Nonwoven, nonbiodegradable, fabric consisting of continuous chain polymer filaments or yarns, at least 85 percent by weight polyolefins, polyesters or polyamide, formed into dimensionally stable network.

B. Chemical Resistance: Inert to commonly encountered chemicals and hydrocarbons over pH range of 3 to 12.

C. Physical Resistance: Resistant to mildew and rot, ultraviolet light exposure, insects and rodents.

D. Minimum Test Values:

Property	**Value (Min.)**	**Test Method**
Grab Strength	180 lbs.	ASTM D 4632
Trapezoidal Tear Strength	50 lbs.	ASTM D 4533
Puncture Strength	80 lbs.	ASTM D 4833
Mullen Burst Strength	290 psi.	ASTM D 3786
Apparent Opening Size(1)	0.25 mm	ASTM D 4751
Permittivity (sec^{-1})	0.2	ASTM D 4491
(1) Maximum average roll value.		

PART 3 EXECUTION

3.01 LINE WORK

A. Conform use of geotextile to backfill for utilities to Section 02317 - Excavation and Backfill for Utilities.

3.02 TUNNEL WORK

A. Use geotextile outside of tunnel primary liner to prevent migration of soil fines into excavated tunnel resulting in voids or settlement. Select geotextile, subject to minimum requirements of Paragraph 2.02, meeting tunnel liner design requirements and installation conditions.

1. Sewers: Conform to Section 02426 - Sanitary Sewer Line in Tunnel.

2. Waterlines: Conform to Section 02517 - Waterline in Tunnels.

END OF SECTION

SECTION 02631

STORM SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. New storm sewers and appurtenances, modifications to existing storm sewer system and installation of roadside ditch culverts.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for storm sewers, including elliptical or box, installed by open-cut, augered with or without casing, or tunneling is on linear foot basis. Measurement for storm sewers and roadside ditch culverts will be taken along center line of pipe from center line to center line of manholes or from end to end of culverts. Payment will be made for each linear foot installed complete in place, including connections to existing manholes and inlets.

2. Payment for storm sewer leads, including elliptical leads, is on a linear foot basis.

3. Payment for corrugated metal pipe storm sewer outfall, including timber bents, is on a linear foot basis.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

1.04 QUALITY ASSURANCE

A. The Condition for acceptance shall be watertight storm sewer that is watertight both in pipe- to-pipe joints and in pipe-to-manhole connections.

B. Provide manufacturer's certification to Specifications.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations.

B. Handle pipe, fittings, and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks or trailers. Do not use materials cracked, gouged, chipped, dented, or otherwise damaged.

C. Store pipe and fittings on heavy timbers or platforms to avoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.

E. Keep interiors of pipe and fittings free of dirt and foreign matter.

F. Store PVC pipe out of direct sunlight.

PART 2 PRODUCTS

2.01 PIPE

A. Provide piping materials for storm sewers shall be of sizes and types specified unless otherwise indicated on Drawings.

B. In diameters where material alternatives are available, provide pipe from single manufacturer for each pipe diameter, unless otherwise approved by Public Works or otherwise shown on Drawings.

C. Existing pipe that has been removed during construction cannot be reused.

2.02 PIPE MATERIAL SCHEDULE

A. Storm Sewer Pipe: Use pipe materials that conforming to requirements specified in one or more of the following Sections as shown on the Drawings.

1. Section 02506 - Polyvinyl Chloride Pipe. Not allowed in the following applications:

a. Potentially Petroleum Contaminated Areas (PPCA).

b. Augering/ jacking

2. Section 02611 - Reinforced Concrete Pipe.

3. Section 02612 - Precast Reinforced Concrete Box Sewers.

4. Section 02642 - Corrugated Metal Pipe use only where Corrugated Metal Pipe is shown on Drawings.

B. Driveway Culvert Pipe for Streets with Open Ditches: Use pipe materials that conforming to requirements specified in one or more of the following Sections as shown on the Drawings.

1. Section 02505 – Polyethylene Pipe. Use for Residential Culverts only. Use Concrete Pipe for long run culverts.

2. Section 02611 - Reinforced Concrete Pipe.

3. Section 02612 - Precast Reinforced Concrete Box Sewers.

C. Provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

D. Pipe materials other than those listed above shall not be used for storm sewers.

2.03 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill Material: Conform to requirements of Sections 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Material, and Section 2321 - Cement Stabilized Sand.

B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

C. Use cement stabilized sand or gravel material for bedding and backfill in the pipe zone for all storm sewers.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affects traffic. Conform to requirements of Section 01555 Traffic Control and Regulation.

B. Provide barricades, flashing warning lights, and signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections while work is in progress or where traffic is affected by work.

C. Immediately notify agency or company owning utility lines which are

damaged, broken, or disturbed. Obtain approval from Public Works and agency for repairs or relocations, either temporary or permanent.

D. Remove old pavements and structures, including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

E. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground Water and Surface Water.

3.02 EXCAVATION

A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade trench from benchmarks identified by Public Works. Maintain this control for minimum of 100-Ft. behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Or use of appropriately sized grade boards which are substantially supported.

C. Trench Excavation. Excavate pipe trenches to level as indicated on Standard Details. Backfill excavation with specified bedding material to level of lower one-third of pipe barrel. Tamp and compact backfill to provide bedding at indicated grade. Form bedding foundation to minimum depth of one-eighth of pipe diameter, but not less than 6-In.

3.03 PIPE INSTALLATION

A. Install in accordance with pipe manufacturer's recommendations and as specified in this section.

B. Install pipe only after excavation is completed, bottom of trench is shaped, bedding material is installed, and trench has been approved by Public Works.

C. Install pipe to line and grade indicated on Drawings. Place pipe so that it has continuous bearing of barrel on bedding material with no voids, and is laid in trench so interior surfaces of pipe follows grades and alignments indicated.

D. Install pipe with bells of pipe facing upstream of anticipated flow.

E. Form concentric joint with each section of adjoining pipe to prevent offsets.

F. Place and drive home newly laid sections with a sling or come-a-long winches to eliminate damage to sections. Unless otherwise approved by Public Works, provide end protection to prevent damage while using back

hoes or similar powered equipment to drive home newly laid sections.

G. Keep interior of pipe clean as installation progresses.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with pipe plug specifically designed to prevent foreign material from entering pipe.

J. For PVC Pipe:

1. Provide a minimum cover as per City Standard detail from top of pavement to top of pipe, but no less than 2-Ft..

2. Accomplish transitions to different material of pipe in a manhole or inlet box. No adapter, coupling for dissimilar pipe, or saddle connections allowed.

3. Provide pipe sections in standard lengths with minimum length of 13-Ft. Pipe may be field modified to shorten length no less than 4-Ft., unless otherwise approved by Public Works. Field modify pipe per manufacturer's recommendations.

4. No beveling at joint allowed. Cut to be perpendicular to longitudinal axis.

5. Provide gasketed bell and spigot joints installed per manufacturer's recommendations. Gasketed pipe joints; clean and free of debris, show no leakage after installation.

3.04 PIPE INSTALLATION OTHER THAN OPEN CUT

A. Conform to requirements of Section 02448 - Pipe and Casing Augering for Sewers where required.

B. Not allowed for plastic sewer pipe.

3.05 INSTALLATION OF APPURTENANCES

A. Construct manholes to conform to requirements of Sections 02081 - Cast-in-place Concrete Manholes, Section 02082 - Precast Concrete Manholes. Install frames, grate rings, and covers to conform to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

B. Install PVC pipe culverts with approved end treatments. Approved end treatments include concrete headwalls, wingwalls and collars.

C. Install inlets, headwalls, and wingwalls to conform to requirements of

Section 02632 - Cast- in-place Inlets, Headwalls, and Wingwalls and Section 02633 - Precast Concrete Inlets, Headwalls, and Wingwalls.

D. Adjust manhole covers and inlets to grade conforming to requirements of Section 02086 - Adjusting Manholes, Inlets, and Valve Boxes to Grade.

3.06 INSPECTION AND TESTING

A. Perform post installation television inspection in accordance with Section 02533 - Gravity Sanitary Sewers. Hand held cameras may be used in storm sewers in lieu of requirements of Paragraph 3.09 of Section 02531 – Gravity Sanitary Sewers. Clearly stencil distance markings on each joint of pipe to indicate distance from starting manhole when using hand held cameras.

3.07 BACKFILL AND SITE CLEANUP

A. Backfill trench after pipe installation is inspected and approved by Public Works.

B. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.

C. Repair and replace removed or damaged pavement and sidewalks as specified in Section 02951 - Pavement Repair and Resurfacing.

D. In unpaved areas, grade surface as uniform slope to natural grade as indicated on Drawings. Provide minimum of 4-In. of topsoil and seed according to requirements of Section 02921- Hydromulch Seeding, or Section 02922 - Sodding, as required.

END OF SECTION

SECTION 02632

CAST-IN-PLACE INLETS, HEADWALLS AND WINGWALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Cast-in-place headwalls including wingwalls for storm sewers.

C. Cast-in-place junction box with lid or grate top.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for inlets is on unit price basis for each inlet installed.

2. Payment for headwalls including wingwalls is on unit price basis for each headwall including wingwall installed.

3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.

4. Payment for inlets and for culvert headwalls including wingwalls and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings for approval of design and construction details for cast-in-place units which differ from units shown on Drawings.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Class A concrete with minimum compressive strength of 4000 psi conforming to requirements of Section 03315 - Concrete for Utility Construction, unless otherwise indicated on Drawings.

B. Reinforcing Steel: Conform to requirements of Section 03315 - Concrete for Utility Construction.

D. Mortar and Hydraulic Cement - Conform to requirements of Section 04061 - Mortar.

E. Miscellaneous metals: Cast-iron frames, grates, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.02 INSTALLATION

A. Construct units complete in place to dimensions, lines and grades as shown on Drawings.

B. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.

C. Construct box section of inlet of Class A.

D. Forms required for both outside and inside faces of concrete inlet walls, however, when nature of material excavated for inlet can be hand trimmed to smooth vertical face, outside forms may be omitted with approval of Public Works.

F. Place reinforcing steel to conform to details shown on Drawings. Provide positive means for holding steel cages in place during concrete placement. Welding of reinforcing steel is not permitted unless noted on Drawings. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus ½-In., whichever is less. Regardless of

variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.

G. Chamfer exposed edges unless otherwise indicated on Drawings.

3.03 FINISHES

A. Cut off inlet leads neatly at inside face of inlet wall. Point up with mortar.

B. When box section of inlet complete, shape floor of inlet with mortar to conform to detailed Drawings.

C. Finish concrete surfaces in accordance with requirements of Section 03315 - Concrete for Utility Construction.

3.04 QUALITY CONTROL

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.05 CONNECTIONS

A. Connect inlet leads to inlets.

B. Seal leads inside and outside with hydraulic cement.

3.06 BACKFILL

A. Backfill area of excavation surrounding each completed inlet according to requirements of Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION

SECTION 02633

PRECAST CONCRETE INLETS, HEADWALLS, AND WINGWALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Precast concrete headwalls and wingwalls for storm sewers.

C. Precast junction box with lid or grate top.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for inlets is on unit price basis for each inlet installed.

2. Payment for headwalls and wingwalls is on unit price basis for each headwall and wingwall installed.

3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.

4. Payment for inlets, headwalls, wingwalls, and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Drawings will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.05 STORAGE AND SHIPMENT

A. Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4000 psi.

B. Reinforcing Steel: Place reinforcing steel to conform to details shown on Drawings and as follows:

1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus ½-In., whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.

2. Welding of reinforcing steel is not permitted unless noted on Drawings.

C. Mortar and Hydraulic Cement: Conform to requirements of Section 04261 - Mortar.

D. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

2.02 SOURCE QUALITY CONTROL

A. Tolerances: Allowable casting tolerances for concrete units are plus or

minus ¼-In. from dimensions shown on Drawings. Concrete thickness in excess of that required will not constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.

B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.

C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:

1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.

2. Surface defects indicating honeycombed or open texture.

3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.

D. Replacement: Immediately remove rejected units from work site and replace with acceptable units.

E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Public Works, repaired units conform to requirements of these specifications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.02 INSTALLATION

A. Install units complete in place to dimensions, lines, and grades as shown on Drawings.

B. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.

C. Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.

D. Provide adequate means to lift and place concrete units.

3.03 FINISHES

A. Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.

B. When box section of inlet has been completed, shape floor of inlet with mortar to conform to Drawing details.

C. Adjust cast iron inlet plate frames to line, grade, and slope shown on Drawings. Grout frame in place with mortar.

3.04 INLET WATERTIGHTNESS

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.05 CONNECTIONS

A. Connect storm sewer leads to inlets as shown on Drawings. Seal connections inside and outside with hydraulic cement. Make connections watertight.

3.06 BACKFILL

A. Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION

SECTION 02642

CORRUGATED METAL PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corrugated metal pipe (CMP).

B. Corrugated metal pipe with smooth interior (CMPSI).

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for corrugated metal pipe in open cut under this Section. Include payment in unit price for Section 02631 - Storm Sewers.

2. No payment will be made for corrugated metal pipe in non-open cut under this Section. Include payment in unit price for applicable tunneling section.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO M 36 - Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

B. AASHTO M 190 - Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.

C. AASHTO M 196 - Corrugated Aluminum Pipe for Sewers and Drains.

D. AASHTO M 197 - Aluminum Alloy Sheet for Corrugated Aluminum Pipe.

E. AASHTO M 218 - Steel Sheet, Zinc Coated (Galvanized) for Corrugated Steel Pipe.

F. AASHTO M 232 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

G. AASHTO M 245 - Corrugated Steel Pipe, Polymer Precoated, for Sewers and Drains.

H. AASHTO M 246 - Steel Sheet, Metallic-Coated and Polymer Precoated for Corrugated Steel Pipe.

I. AASHTO M 274 - Steel Sheet, Aluminum-Coated (Type 2) for Corrugated Steel Pipe.

J. ASTM B 633 - Standard Specification for Electro deposited Coatings of Zinc on Iron and Steel.

K. ASTM A 760 - Standard Specifications for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings with following information:

1. Design dimensions and details for pipe and fittings indicating alignment, grade, and laying dimensions.

2. Fabrication details, details of fittings and flanges, details of specials, and proposed welding procedures.

3. Show station numbers for pipe and fittings corresponding to Drawings.

1.05 QUALITY ASSURANCE

A. Provide manufacturer's affidavits that pipe was manufactured in compliance with standards referenced in this Section, and that coatings and linings were not applied or allowed to cure in freezing temperatures.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Corrugated metal pipe may be galvanized steel, aluminized steel, aluminum or precoated galvanized steel as indicated on Drawings and conforming to following:

Galvanized Steel	AASHTO M 218

Aluminized Steel	AASHTO M 274
Aluminum	AASHTO M 197
Precoated Galvanized Steel	AASHTO M 246

1. Reference to gauge of metal is to U.S. Standard Gauge for uncoated sheets. Tables in AASHTO M 218 and AASHTO M 274 list thicknesses for coated sheets in inches. Tables in AASHTO M 197 list thicknesses in inches for clad aluminum sheets.

B. Coupling bands and other hardware for galvanized or aluminized steel pipe shall conform to requirements of AASHTO M 36 for steel pipe and AASHTO M 196 for aluminum pipe.

1. Coupling bands shall be not more than 3 nominal sheet thicknesses lighter than thickness of pipe to be connected and in no case lighter than 0.052-In. for steel or 0.048-In. for aluminum.

2. Coupling bands shall be made of same base metal and coating (metallic or otherwise) as pipe.

3. Minimum width of corrugated locking bands shall be as shown below for corrugations which correspond to end circumferential corrugations on pipes being joined:

   a. 10-1/2-In. wide for 2-2/3-In. by ½-In. corrugations.

   b. 12-In. wide for 3-In. by 1-In. corrugations.

4. Helical pipe without circumferential end corrugations will be permitted only when it is necessary to join new pipe to existing pipe which was installed with no circumferential end corrugations. In this event pipe furnished with helical corrugations at ends shall be field jointed with either helically corrugated bands or with bands with projections(dimples). Minimum width of helical corrugated bands shall conform to following:

   a. 12-In. wide for ½-In. deep helical end corrugations.

   b. 14-In. wide for 1-In. deep helical end corrugations.

5. Bands with projections shall have circumferential rows of projections with one projection for each corrugation. Width of bands with projections shall be not less than following:

   a. 12-In. wide for pipe diameters up to and including 72-In.

Bands shall have two circumferential rows of projections.

b. 16-1/4-In. wide for pipe diameters of 78-In. and greater. Bands shall have four circumferential rows of projections.

6. Bolts for coupling bands shall be ½-In. diameter. Bands 12-In. wide or less will have minimum of 2 bolts per end at each connection, and bands greater than 12-In. wide shall have minimum of 3 bolts at each connection.

7. Galvanized bolts may be hot dip galvanized in accordance with requirements of AASHTO M 232, mechanically galvanized to provide same requirements as AASHTO M 232, or electro galvanized per ASTM B 633, Type RS.

C. Coat bituminous coated pipe or pipe arch inside and out with bituminous coating which shall meet these performance requirements and requirements of AASHTO M 190.

1. Uniformly coat pipe inside and out to minimum thickness of 0.05-In., measured on crests of corrugations.

2. Adhere bituminous coating to metal so that it will not chip, crack, or peel during handling and placement; and to protect pipe from corrosion and deterioration.

3. Where paved invert is shown on Drawings, pipe or pipe arch, in addition to fully-coated treatment described above, shall receive additional bituminous material, same as specified above, applied to bottom quarter of circumference to form smooth pavement. Maintain minimum thickness of 1/8-In. above crests of corrugations.

D. Furnish fittings and specials required for bends, end sections, branches, access manholes, and connections to other fittings. Design fittings and specials in accordance with Drawings and ASTM A 760. Fittings and specials are subject to same internal and external loads as straight pipe.

2.02 PIPE FABRICATION

A. Steel Pipe:

1. Galvanized or aluminized steel pipe shall be full circle or arch pipe conforming to AASHTO M 36, Type I, Type IA, or Type II, as indicated on Drawings.

2. Fabrication with circumferential corrugations, lap joint construction with riveted or spot- welded seams, helical corrugations with continuous helical lock seam, or ultra-high frequency resistance butt-welded seams is acceptable.

B. Aluminum Pipe:

1. Conform to requirements of AASHTO M 196, Type I, Type IA, circular pipe, or Type II, pipe arch as indicated on Drawings.

2. Fabrication with circumferential corrugations, lap joint construction with riveted or spot- welded seams, or helical corrugations with continuous helical lock seam.

3. Portions of aluminum pipe that will be in contact with concrete or metal other than aluminum shall be insulated from these materials with coating of bituminous material meeting requirements of AASHTO M 190. Extend coating minimum distance of one foot beyond area of contact.

C. Precoated Galvanized Steel Pipe:

1. Pipe shall be full circle or arch pipe conforming to AASHTO M 245, Type I, Type IA or Type II as indicated on Drawings.

2. Fabrication with circumferential corrugations, lap joint construction with riveted seams, or helical lock seams is acceptable.

3. Inside and outside coating shall be minimum of 10 mils.

PART 3 EXECUTION

3.01 PREPARATION

A. Repair damaged spelter coating by thoroughly wire brushing damaged area and removing all loose, cracked, or weld-burned spelter coating. Paint cleaned area with zinc dust-zinc oxide paint conforming to Federal Specifications TT-P-641g.

B. Repair damaged aluminized or polymer coating in accordance with manufacturer's recommendations.

3.02 EARTHWORK

A. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities, except where tunneling or jacking

methods are shown on Drawings. When pipes are laid in trench, trench when completed and shaped to receive pipe, shall be of sufficient width to provide free working space for satisfactory bedding and jointing and thorough tamping of backfill and bedding material under and around pipe.

B. Bed pipe in accordance with Drawings. When requested by Public Works, furnish simple template for each size and shape of pipe for use in checking shaping of bedding. Template shall consist of thin plate or board cut to match lower half of cross section.

C. Where rock in either ledge or boulder form exists below pipe, remove rock below grade and replace with suitable materials so slightly yielding compacted earth cushion is provided below pipe minimum of 12-In. thick.

D. Remove and replace where soil encountered at established grade is quicksand, muck or similar unstable materials in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities. Do not allow cement stabilized materials for backfill to come into contact with uncoated aluminum or aluminized pipe surface.

E. After metal pipe structure has been completely assembled on proper line and grade and headwalls constructed when required by drawing details, place selected material from excavation or borrow along both sides of completed structures equally, in uniform layers not exceeding 6-In. in depth (loose measurement), wetted when required and thoroughly compacted between adjacent structures and between structure and sides of trench, or for distance each side of structure equal to diameter of pipe. Compact backfill material to same density requirements as specified for adjoining sections of embankment in accordance with specifications.

Above three-fourths point of structure, place uniformly on each side of pipe in layers not to exceed 12-In.

F. Only hand operated tamping equipment will be allowed within vertical planes 2-Ft. beyond horizontal projection of outside surface of structure for backfilling, until minimum cover of 12-In. is obtained. Remove and replace damaged pipe.

G. Do not permit heavy earth moving equipment to haul over structure until minimum of 4-Ft. of permanent or temporary compacted fill has been placed.

H. During backfilling, obtain uniform backfill material and uniform compacted density throughout length of structure to avoid unequal pressure. Provide proper backfill under structure.

I. Prior to adding each new layer of loose backfill material, inspection will be made of inside periphery of structure for local or unequal deformation caused by improper construction methods. Evidence of deformation will be reason for corrective measures as may be directed by Public Works.

3.03 PIPING INSTALLATION

A. Place pipes on prepared foundation starting at outlet end. Join sections firmly together, with side laps or circumferential joints pointing upstream and with longitudinal laps on sides.

B. Coat metal in joints not protected by galvanizing or aluminizing with approved asphaltum paint.

C. Provide proper equipment for hoisting and lowering sections of pipe into trench without damaging pipe or disturbing prepared foundation and sides of trench. Take up and re-lay pipe which is not in alignment or which shows undue settlement after laying, or is damaged.

D. Lay multiple installations of corrugated metal pipe and pipe arches with center lines of individual barrels parallel. Unless otherwise indicated on Drawings, maintain following clear distances between outer surfaces of adjacent pipes:

Diameter of Pipe	**Clear Distance Between Pipes Full Circle and Pipe Arch**	**Pipe Arch Design No.**
18”	1’ – 2”	2
24”	1’ – 5”	3
30”	2’ – 8”	4
36”	1’ – 11”	5
42”	2’ – 2”	6
48”	2’ – 5”	7
54”	2’ – 10”	8
60” – 84”	3’ – 2”	9
90” – 120”	3’ – 5”	10 & Over

E. Where extensions are attached to existing structures, install proper connection between structure and existing as indicated on Drawings, coat connection with bituminous material when required.

F. When existing headwalls and aprons are indicated for reuse on Drawings, sever portion to be reused from existing culvert, and relocate to prepared position. Restore damaged headwalls, aprons or pipes attached to headwall to their original condition.

3.04 JOINTING

A. Use field joints to maintain pipe alignment during construction and prevent infiltration of side material.

B. Lap coupling bands equally on pipes being connected to form tightly-closed joint.

C. Use corrugated locking bands to field join pipes furnished with circumferential corrugations including pipe with helical corrugations having reformed circumferential corrugations on ends. Fit locking bands into minimum of one full circumferential corrugation of pipe ends being coupled.

END OF SECTION

SPECIFICATION 02700

CEMENT KILN DUST TREATMENT AND STREET RECLAMATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mix and compact cement kiln dust (CKD), water, and subgrade or base (with or without asphalt concrete pavement) in the roadway

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for Cement Kiln Dust will be paid for by the ton at the unit price bid for “Cement Kiln Dust.” This price is full compensation for materials, delivery, equipment, labor, tools, and incidentals

2. Payment for cement kiln dust treatment will be paid for by the cubic-yard at the unit price bid for “Street Reclamation,” all depths. No additional payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, providing cement kiln dust, spreading, applying cement kiln dust, compacting, finishing, curing, curing materials, blading, shaping and maintaining shape, replacing mixture, disposing of loosened materials, processing, hauling, preparing secondary subgrade, water, equipment, labor, tools, and incidentals.

3. Payment for furnishing and delivering new base, if required, will be paid for in accordance with “Flexible Base, Supplemental.” Mixing, spreading, blading, shaping, compacting, and finishing reclaimed existing asphalt pavement and base material will be paid for under “Street Reclamation.”

4. Sprinkling and rolling, except proof-rolling, will not be paid for directly but will be subsidiary to this Item, unless otherwise shown on the plans. When proof-rolling is shown on the plans or directed by the Engineer, it will be paid for in accordance with TxDOT Item 216, “Proof Rolling.”

5. Where subgrade is constructed under this Contract, correction of soft spots in the subgrade or existing base will be at the Contractor’s expense. Where subgrade is not constructed

under this Contract, correction of soft spots in the subgrade or existing base will be in accordance with Item “Flexible Base Supplemental.”

6. Asphalt used solely for curing will not be paid for directly, but will be subsidiary to this Item. Asphalt placed for the purpose of curing and priming will be paid for under “Prime Coat.”Measurement

7. Measurement

a. Cement Kiln Dust. Cement kiln dust will be measured by the ton (dry weight). When cement kiln dust is furnished in trucks, the weight of cement kiln dust will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of TxDOT Item 520, “Weighing and Measuring Equipment.”

b. When cement kiln dust is furnished in bags, indicate the manufacturer’s certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer’s certified weight.

c. Cement kiln dust slurry will be measured by the ton (dry weight) of the cement kiln dust used to prepare the slurry at the job site or from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.01 REFERENCES

A. TxDOT Item 520, “Weighing and Measuring Equipment.”

C. TxDOT Item 216, “Proof Rolling.”

D. TxDOT Item 204, “Sprinkling.”

E. TxDOT Tex-100-E

F. TxDOT Tex-115-E

G. TxDOT Tex-145-E

H. TxDOT Tex-620-

I. TxDOT Tex-146-E

J. TxDOT Tex-129-E

1.01 SUBMITTALS

A. Certify compliance with TXDOT DMS-11000

B. Provide certification of Cement Kiln Dust production testing data showing compliance with the following requirements:

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Certify compliance with TXDOT DMS-11000, “Evaluating and Using Non-Hazardous Recyclable Materials Guidelines.” Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction. Use TxDOT standard laboratory test procedure Tex-100-E for material definitions.

B. Furnish a mixture with a sulfate content less than or equal to 3000 ppm when tested in accordance with Tex-145-E. When reinforced concrete will be in contact with the mixture, furnish a mixture with a chloride content less than or equal to 1000 ppm when tested in accordance with Tex-620-J.

C. When steel elements will be in contact with the mixture, the resistivity will be more than 3000 ohms-cm as determined by Tex-129-E. Material with a resistivity between 1500 and 3000 ohms-cm may be used provided the chloride content does not exceed 100 ppm as determined by Tex-146-E and the sulfate content does not exceed 200 ppm as determined by Tex-145-E.

D. Cement Kiln Dust. Furnish cement kiln dust (CKD) of uniform consistency that meets the requirements contained herein. The supplier must fully comply with all rules and regulations concerning health and safety issues by all appropriate regulating entities. When requested, provide documentation demonstrating compliance with the following table:

Table 1 02700-1

Items tested at least weekly:	
Sulfur Trioxide (SO_3), maximum, percent, as measured by ASTM C 114	10.0
Equivalent Alkalies ($Na_2O + 0.658K_2O$), maximum, percent, as measured by ASTM C 114	10.0
Moisture Content, maximum, percent, as measured by ASTM C 114	3.0
pH, minimum	12.0
Chloride, maximum, percent, as measured by ASTM C 114	5.0
Total Calcium Oxide (CaO), maximum percent variation, from the certified CaO content of sample provided for determination of addition rates during mixture design shall not exceed plus or minus, as measured by ASTM C 114	12.0
Total Free Lime, maximum percent variation, from the certified free lime content of the sample provided during mixture design, as measured by ASTM C 114	30.0
Loss on Ignition (LOI), variation in percentage points of LOI from the certified total LOI of the sample provided during mixture design shall not exceed plus or minus, as measured by ASTM C 114	5.0
Fineness, variation in percentage points retained on the No. 325 (45 µm) sieve from the certified percentage of sample provided for determination of addition rates during mixture design shall not exceed plus or minus, as measured by ASTM C 430	5.0
Items tested semi-annually	
Increase of drying shrinkage of mortar bars at 28 days, maximum, percent, as measured by ASTM C 157	0.03
Include with the certification average test results for the following additional properties: SiO_2, Al_2O3, Fe_2O3, MgO and volatiles	

E. Flexible Base. Furnish base material that meets the requirements of TxDOT Item 247, “Flexible Base,” for the type and grade shown on the plans, before the addition of cement kiln dust.

F. Water. Furnish water free of industrial waste and other objectionable material.

G. Asphalt. When permitted for curing purposes, furnish asphalt or emulsion that meets the requirements of TxDOT Item 300, “Asphalts, Oils, and Emulsions,” as shown on the plans or directed.

2.02 MIX DESIGN.

A. Unless otherwise stated, the Engineer will determine the target cement kiln dust content and optimum moisture content to produce a stabilized mixture that meets the strength requirements shown on the plans. The mix will be designed in accordance with Tex-120-E or will be based on prior experience with the project materials. The Contractor may propose a mix design developed in accordance with Tex-120-E. The Engineer will use Tex-120-E to verify the Contractor’s proposed mix design before acceptance. Reimburse the City for subsequent mix designs or partial designs necessitated by changes in the material or requests by the Contractor. When treating existing materials, limit the amount of asphalt concrete pavement to no more than 50% of the mix unless otherwise shown on the plans or directed.

2.03 EQUIPMENT

A. Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with TxDOT Item 210, “Rolling.” Provide proof rollers in accordance with TxDOT Item 216, “Proof Rolling,” when required

B. Cement Kiln Dust Storage Facility. Store cement kiln dust in closed, weatherproof containers.

C. Cement Kiln Dust Slurry Equipment. Use slurry tanks equipped with agitation devices to slurry cement kiln dust on the project or other approved location. The Engineer may approve other slurrying methods. Provide a pump for agitating the slurry when the distributor truck is not equipped with an agitator. Equip the distributor truck with an approved sampling device.

D. Pulverization Equipment. Provide pulverization equipment that:

1. cuts and pulverizes material uniformly to the proper depth with cutters that will plane to a uniform surface over the entire width of the cut;

2. provides a visible indication of the depth of cut at all times; and

3. uniformly mixes the materials.

PART 3 EXECUTION

1.02 CONSTRUCTION

A. Construct each layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

3.02 PREPARATION OF SUBGRADE OR EXISTING BASE FOR TREATMENT

A. Before treating, reclaim existing asphalt concrete pavement and base to the required depth in accordance with pertinent Items and the plans or as directed. As required, excavate, treat, and shape existing subgrade in accordance with applicable bid items to conform to the typical sections shown on the plans or as directed.

B. When shown on the plans or directed, proof roll the roadbed in accordance with TxDOT Item 216, “Proof Rolling,” before replacing reclaimed material. Correct soft spots as directed.

C. When required per typical section shown on the plans or as directed, reclaimed existing asphalt concrete pavement and base, treated with cement kiln dust, shall be placed prior to addition of new base material.

3.03 PULVERIZATION

A. Pulverize or scarify existing material after shaping so that 100% passes a 2-1/2-in. sieve. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to plan depth.

3.04 APPLICATION OF CEMENT KILN DUST

A. Uniformly apply cement kiln dust using dry placement unless otherwise shown on the plans. Add cement kiln dust at the percentage determined in per Mix Design. Apply cement kiln dust only on an area where mixing, compacting, and finishing can be completed during the same working day.

1. Start cement kiln dust application only when the air temperature is at least 35°F and rising or is at least 40°F. The temperature will be taken in the shade and away from artificial heat. Suspend application when the Engineer determines that weather conditions are unsuitable.

2. Dry Placement. Before applying cement kiln dust, bring the prepared roadway to approximately optimum moisture content. When necessary, sprinkle in accordance with TxDOT Item 204, "Sprinkling." Distribute the required quantity of dry cement kiln dust with approved equipment. Minimize dust and scattering of cement kiln dust by wind. Do not apply cement kiln dust when wind conditions, in the opinion of the Engineer, cause blowing cement kiln dust to become dangerous to traffic or objectionable to adjacent property owners.

3. Slurry Placement. Mix the required quantity of cement kiln dust with water, as approved. Provide slurry free of objectionable materials and with a uniform consistency that can be easily applied. Agitate the slurry continuously. Apply slurry within 2 hours of adding water and when the roadway is at a moisture content drier than optimum. Distribute slurry uniformly by making successive passes over a measured section of the roadway until the specified cement kiln dust content is reached.

3.05 MIXING

A. Thoroughly mix the material and cement kiln dust using approved equipment. Mix until a homogeneous mixture is obtained. Sprinkle the treated materials during the mixing operation, as directed, to maintain optimum mixing moisture. Spread and shape the completed mixture in a uniform layer.

4. After mixing, the Engineer will sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III, to determine compliance with the gradation requirements in Table 02700-2.

Table 02700-2 Gradation Requirements

	Minimum % Passing	
Sieve Size	**Base**	**Subgrade**
1-3/4 in.	100	100
3/4 in.	85	85
No. 4	–	60

3.06 Compaction.

A. Compact the mixture in one lift using density control unless otherwise shown on the plans. Unless otherwise shown on the plans, complete compaction of base within 2 hours and subgrade within 6 hours after the application of cement kiln dust.

1. Sprinkle or aerate the treated material in accordance with TxDOT Item 204, “Sprinkling,” to adjust the moisture content during compaction so that it is within 2.0 percentage points of optimum as determined by Tex-120-E. Determine the moisture content of the mixture at the beginning and during compaction in accordance with Tex-103-E. Adjust operations as required.

2. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least one-half the width of the roller unit. On superelevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 MPH, as directed.

3. Remove areas that lose required stability, compaction, or finish. Replace with cement kiln dust-treated mixture at the Contractor’s expense.

B. Ordinary Compaction. Roll with approved compaction equipment, as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.

C. Density Control. Compact to at least 95% of the maximum density determined in accordance with Tex-120-E. The Engineer will determine roadway density immediately after completion of compaction in accordance with Test Method Tex-115-E and will verify strength in accordance with Tex-120-E. Remove material that does not meet density requirements. Replace with cement kiln dust-treated mixture and compact and test in accordance with density control methods.

1. the Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.

3.07 FINISHING

A. Immediately after completing compaction, clip, skin, or tight-blade the surface of the cement kiln dust treated material with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Roll the clipped surface immediately with a pneumatic-tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines and grades shown on the plans or as directed.

1. In areas where surfacing is to be placed, trim grade deviations greater than 1/4 in. in 16 ft. measured longitudinally or greater than 1/4 in. over the entire width of the cross-section. Remove excess material, reshape, and roll with a pneumatic-tire roller. If material is more than 1/4 in. low, correct as directed. Do not surface-patch.

3.08 CURING

A. Cure the finished section until the moisture content is at least 2 percentage points below optimum or as directed before applying the next successive course or prime coat. Do not allow equipment or traffic on the finished course during curing, unless otherwise approved. The Engineer may allow traffic on the finished course during curing if proof rolling indicates adequate stability. Proof roll in accordance with TxDOT Item 216, “Proof Rolling.” If deformation occurs, do not allow traffic to return to the finished section until the mixed material is firm enough to accommodate traffic without deformation. Apply seals or additional courses within 14 calendar days of final compaction.

B. When the plans show no specific detour, the Contractor will provide one-way traffic control until proof rolling permits the return of normal traffic to the compacted material.

END SECTION

SECTION 02711

ASPHALT TREATED BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foundation course of compacted mixture of coarse and fine aggregates, and asphalt binder.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hot mix asphalt base is on a per square yard basis. Separate pay items are used for each different required thickness of base course.

2. Measurement for utility projects:

a. Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.

b. Include installed hot mix asphalt base course material that extends one foot beyond outside edge of pavement to be replaced, except where proposed pavement section shares common edge with existing pavement section.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO T201 - Standard Specification for Kinematic Viscosity of Asphalts (Bitumens).

B. AASHTO T202 - Standard Specification for Viscosity of Asphalt by Vacuum Capillary Viscometer.

C. ASTM C 33 - Standard Specifications for Concrete Aggregate.

D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

E. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM D 4402 - Standard Test Method for Viscosity Determination of unfilled Asphalt Using the Broolfield Thermal Apparatus.

G. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils.

H. TxDOT Tex-126-E - Molding, Testing, and Evaluating Bituminous Black Base Material.

I. TxDOT Tex-200-F- Sieve Analysis of Fine and Coarse Aggregates.

J. TxDOT Tex-203-F - Sand Equivalent Test.

K. TxDOT Tex-204-F - Design of Bituminous Mixtures.

L. TxDOT Tex-207-F - Determining Density of Compacted Bituminous Mixtures.

M. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

N. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certificates that asphalt materials and aggregates meet requirements of Paragraph 2.01, Materials.

C. Submit proposed mix and test data for each type of base course in work.

D. Submit manufacturer's description and characteristics of mixing plant for approval.

E. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 PRODUCTS

2.01 MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. When a source change occurs, the Engineer will verify that the specification requirements are met and may require a new laboratory mixture design. Use TxDOT standard laboratory test procedure Tex-100-E for material definitions.

A. Aggregate. Furnish natural aggregates or crushed concrete unless otherwise shown on the plans. When shown on the plans, other recycled

materials, including reclaimed asphalt concrete pavement (RAP), are allowed up to the maximum percentage shown on the plans. Stockpile aggregates for each source and type separately. Do not add material to an approved stockpile unless approved by the Engineer.

Furnish aggregates that conform to the requirements shown in Table 1 and specified in this Section unless otherwise shown on the plans. Each source must meet the requirements of Table 1. The Engineer may allow testing of the proposed combined aggregates, rather than each source, to meet Table 1 requirements.

Table 1 Aggregate Quality Requirements

Property	Test Method[1]	Specification Requirement
Wet ball mill, % max	Tex-116-E	50
Max increase, % passing #40		20
Los Angeles abrasion[2], % max	Tex-410-A 50	50
Liquid limit, max	Tex-104-E	40
Plasticity index, max	Tex-106-E	10
Sand equivalent, % min	Tex-203-F	40
Decantation[3], % max	Tex-406-A	5.0
Crushed faces, % min	Tex-460-A	60

1. TxDOT standard laboratory test procedure.
2. Use only when shown on the plans, instead of wet ball mill test.
3. Required only for RAP stockpiles and recycled aggregates when more than 30% RAP is allowed.

B. Recycled Materials. The use of recycled materials is allowed only when shown on the plans. Crushed concrete, RAP (except for City furnished RAP), and other recycled materials must meet the requirements of this Article. Request approval to blend 2 or more sources of recycled materials.

1. Limits on Percentage. When RAP is allowed by the plans, use no more than 30% unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans.

2. Recycled Material (Including Crushed Concrete) Requirements.

a. Contractor Furnished Recycled Materials. When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of this Article and Table 2 for the grade specified. Certify compliance with TxDOT's DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines," for Contractor-furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5% deleterious material when tested in accordance with TxDOT standard laboratory test procedure Tex-413-A. The unblended recycled materials (crushed concrete and RAP) must

not exceed the decantation shown in Table 1. Test RAP without removing the asphalt. Do not use RAP that is contaminated by dirt or other objectionable material. Crushed concrete must be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.

When more than 30% Contractor-owned recycled materials is allowed and used, the individual materials are subject to the requirements of Table 1.

• Contractor furnished materials are subject to the requirements in Table 1 and this Item, and • the final product, blended or unblended, will be subject to the requirements in Table 2.

b. Allowed Recycled Materials. When the City allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of this Article, Table 2, and the plans.

3. Recycled Material Sources. The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Remove Contractor-owned recycled materials from the project and dispose of it in accordance with federal, state, and local regulations before project acceptance.

C. Asphalt Material. Furnish the type and grade of asphalt binder specified on the plans. Provide asphalt binder that meets requirements of TxDOT Item 300, “Asphalts, Oils and Emulsions.” When more than 30% RAP is allowed and used, ensure that the new binder and recovered binder from the RAP, when blended proportionally, meet the PG binder designation shown on the plans.

D. Tack Coat. Unless otherwise shown on the plans or approved, furnish CSS 1H, SS 1H, or a PG binder with a minimum high temperature grade of PG 58 for tack coat binder and in accordance with Section 02743 “Tack Coat” and TxDOT Item 300, “Asphalts, Oils, and Emulsions.”

Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use. If required, verify that emulsified asphalt proposed for use meets the minimum residual asphalt percentage specified in TxDOT Item 300, “Asphalts, Oils, and Emulsions.”

E. Additives. When shown on the plans, use the type and rate of additive specified. Other additives that facilitate mixing or improve the quality of the mix may be allowed when approved.

If lime or a liquid anti-stripping agent is used, add in accordance with TxDOT

Item 301, “Asphalt Anti-stripping Agents.” Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the fines back into the drum.

2.02 EQUIPMENT

A. Provide machinery, tools, and equipment in accordance with TxDOT Item 320, “Equipment for Production, Hauling, and Placement of Hot-Mixed Asphalt Materials.”

PART 3 EXECUTION

3.01 CONSTRUCTION

Produce, haul, place, and compact the specified mixture in accordance with the requirements of this Item.

A. Mixture Design. Using TxDOT standard laboratory test procedure Tex-126-E and the materials proposed for the project, the Engineer will determine the target asphalt content required to produce a mixture meeting the requirements in Table 2 for the grade shown on the plans. The gradation of the combined aggregates will be determined in accordance with TxDOT standard laboratory test procedure Tex-200-F, Part I. The Engineer may accept a design from the Contractor that is performed in accordance with TxDOT standard laboratory test procedure Tex-126-E. Reimburse the City for subsequent mixture designs or partial designs necessitated by changes in the material or requests by the Contractor.

The mixture must contain between 4.0% and 9.0% asphalt when designed in accordance with TxDOT standard laboratory test procedure Tex-126-E. The Engineer will evaluate the mixture for moisture susceptibility in accordance with TxDOT standard laboratory test procedure Tex-530-C unless otherwise shown on the plans. A maximum of 10% stripping is allowed unless otherwise shown on the plans. The test sample will be retained and used to establish a baseline for comparison to production results. The Engineer may waive this test if a similar design using the same materials has proven satisfactory.

Produce a trial batch using the proposed project materials and equipment in a large enough quantity to ensure that the mixture is representative of the mixture design. The City will verify the strength requirement in Table 2 is met. The Engineer may waive trial mixtures if similar designs have proven satisfactory.

Table 2 Mix Requirements

Master Gradation Bands Tex-200-F, Part I[1], % Passing by Weight				
Sieve Size	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**
1-¾"		100	100	As shown on the plans
1-½"	100	90–100		
1"	90–100			
⅜"	45–70			
#4	30–55	25–55		
#40	15–30	15–40	15–40	
Strength Requirements				
Slow strength, psi, min[2]	50	40	30	30[3]

1. TxDOT standard laboratory test procedure.
2. TxDOT standard laboratory test procedure Tex-126-E, at optimum asphalt content.
3. Unless a higher minimum strength is shown on the plans.

B. Production Operations. Produce a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for non-compliance to the specification.

1. Storage and Heating of Materials. Do not heat the asphalt binder above the temperature specified in TxDOT Item 300, "Asphalts, Oils and Emulsions," or outside the manufacturer's recommended values. On a daily basis, provide the Engineer with the records of asphalt binder and hot mix asphalt discharge temperatures in accordance with TxDOT Item 320, "Equipment for Hot Mix Asphalt Materials." Unless otherwise approved, do not store hot mix for more than 12 hours or for a time period less than 12 hours that affects the quality of the mixture.

2. Mixing and Discharge of Materials. Notify the Engineer of the target discharge temperature and produce the mixture within 25ºF of the target. When ordinary compaction is used, the Engineer will select a target discharge temperature between 225ºF and 350ºF. Produce the mixture within 25ºF of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350ºF. The City will not pay for or allow placement of any mixture produced at more than 350ºF.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. The Engineer may perform TxDOT standard laboratory test procedure Tex-212-F, Part II, to verify that the mixture contains no more than 0.2% moisture by weight. The sample will be taken immediately after the mixture is discharged into the truck and tested promptly.

C. Hauling Operations. Before use, clean all truck beds to ensure that the

mixture will not become contaminated. When a release agent is necessary, use a release agent on the approved list maintained by the TxDOT Construction Division to coat the truck bed.

D. Placement Operations. Prepare the surface by removing objectionable material such as moisture, dirt, sand, leaves and other loose impediments before placing the mixture. Coordinate mixture delivery and paver speed to ensure a continuous placement operation. Suspend placement operations when, in the opinion of the Engineer, a continuous paving operation is not maintained. Place the mixture to produce a smooth, finished surface with a uniform appearance and texture that meet typical section requirements. Offset longitudinal joints of successive courses of treated base by at least 6 inches. Place the mix adjacent to gutters and structures so that the pavement will drain properly.

1. Weather Conditions. Tack coat and mixture may be placed only when the roadway surface temperature is 50ºF or higher unless otherwise approved. Measure the roadway surface temperature with a handheld infrared thermometer. Place tack coat or mixtures only when the Engineer determines that general weather conditions and moisture conditions of the roadway surface are suitable. The Engineer may waive placement temperature requirements.

2. Tack Coat. Clean the surface before placing the tack coat. Unless otherwise approved, apply tack coat uniformly at a rate between 0.04 and 0.10 gallon of residual asphalt per square yard of surface area. Apply a thin uniform tack coat to all contact surfaces of curbs, structures, and joints. Prevent splattering of tack coat when placed adjacent to curbs, gutters, and structures. Roll the tack coat with a pneumatic tire roller unless otherwise directed. The Engineer may use TxDOT standard laboratory test procedure Tex-243-F to verify that the tack coat has adequate adhesive properties. The Engineer may suspend paving operations until there is adequate adhesion. The Engineer may waive the requirement to place tack coat.

3. Lay Down Operations. Dump and spread the asphalt mixture on the approved prepared surface with a spreading and finishing machine. Place the material without tearing, shoving, gouging, or segregating the mixture.

Do not jar or bounce the finishing machine when loading it. Obtain the required lines and grades without hand finishing. The Engineer may authorize hand finishing when the mixture is:

- placed in a narrow strip along the edge of existing pavement,
- used to level small areas, or

• placed in small irregular areas where the use of a finishing machine is not practical.

Leveling courses and other areas may be spread with a motor grader when shown on the plans or approved.

When hot mix is placed in windrows, operate windrow pick-up equipment so that substantially all the mixture deposited on the roadbed is picked up and loaded into the spreading and finishing machine.

Adjust the hopper flow gates of the spreading and finishing machine to provide an adequate and consistent flow of material. Operate the augers at least 85% of the time. Keep the augers one-half to three-quarters full of mixture. Maintain an adequate flow of material to the center of the paver for the full width of the mat.

Immediately take appropriate corrective action if surface irregularities including but not limited to segregation, rutting, raveling, flushing, fat spots, mat slippage, color, texture, roller marks, tears, gouges, or streaks are detected. Continue placement for no more than 1 day of production while appropriate action is taken. If no appropriate corrective action is taken or if the problem still exists after 1 day, suspend paving until the Engineer approves further production.

E. Compaction. Uniformly compact the pavement to the density requirements of this Item. Use the procedure described in TxDOT standard laboratory test procedure Tex-207-F, Part IV, to establish the rolling pattern. Do not use pneumatic tire rollers if excessive pickup of fines by roller tires occurs.

When using three-wheel, tandem, or vibratory rollers, first roll the joint with the adjacent pavement. Continue rolling longitudinally at the sides, proceeding toward the center of the pavement, and overlap successive trips by at least one foot unless otherwise directed. Make alternate trips of the roller slightly different in length. Begin rolling of super-elevated curves at the low side and proceed toward the high side, unless otherwise directed.

When operating vibratory rollers:

• do not operate in vibrating mode when stationary;

• do not operate in vibrating mode when changing directions;

• do not operate in vibrating mode on mats with a plan depth of less than 1-½ in.;

• do not allow the roller to stand on pavement that has not been fully compacted;

• do not operate when in contact with the compacted, finished pavement structure layer;

• in case of over-vibration resulting in disruption of the compacted material, rework and recompact or replace the damaged material at the Contractor's expense;

• roll at a speed producing at least 10 blows per foot unless otherwise directed;

• keep the drums moist with water without using excess water; and

• do not drop diesel, gasoline, oil, grease, or other foreign matter on the pavement.

Where specific air void requirements are waived, furnish and operate compaction equipment as approved. Use lightly oiled tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not permit thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

In-place compaction control is required for all mixtures. Complete all rolling for compaction before the mixture temperature drops below 175ºF. Unless otherwise shown on the plans, use density control.

Density Control. Determine the number and type of rollers needed to obtain the required density. Operate the rollers in accordance with the requirements of this specification and as approved.

Place and compact material to the minimum density of 95 to 100 percent as determined by TxDOT standard laboratory test procedure Tex-126-E or as shown on the plans. The Engineer will determine laboratory-molded density in accordance with TxDOT standard laboratory test procedure Tex-126-E from material sampled at the plant. Actual in-place density will be determined in accordance with TxDOT standard laboratory test procedure Tex-126-E unless otherwise directed. Unless otherwise shown on the plans, obtain required roadway specimens as directed. The Engineer will measure air voids in accordance with TxDOT standard laboratory test procedure Tex-207-F. When a satisfactory correlation to results obtained in accordance with TxDOT standard laboratory test procedure Tex-126-E is shown, other methods of determining in-place compaction may be used.

If in-place density is more than 1.0 percentage point below minimum density, cease production immediately. If in-place density is between 0.1

and 1.0 percentage points below minimum density, investigate the causes and make the necessary corrections. If minimum density is not obtained within one full day of operation, cease production. Resume production after placing a test section of one lane width and a maximum 0.2 miles long that demonstrates that minimum density can be obtained. Repeat this procedure until producing a test section that meets minimum density requirements. Place no more than 2 test sections per day. Increasing the asphalt content of the mixture to increase in-place density is allowed by approval only.

Ordinary Compaction. When ordinary compaction is required by the plans, furnish one three-wheel roller, one pneumatic tire roller, and one tandem roller, as directed, for each compaction operation. The Engineer may waive the use of the tandem roller when the surface is adequately smooth and further steel wheel rolling is shown to be ineffective. The Engineer may allow a vibratory roller to be substituted for the three-wheel roller, the tandem roller, or both. Use at least one pneumatic tire roller. Pneumatic tire rollers will provide a minimum of 80 psi ground contact pressure when used for compaction and a minimum of 55 psi ground contact pressure when used for kneading and sealing the surface. Provide additional rollers as directed.

Establish rolling patterns in accordance with TxDOT standard laboratory test procedure Tex-207-F, Part IV, unless otherwise directed. Follow the selected rolling pattern unless changes in mixture or placement conditions that affect compaction occur. When changes occur, establish a new rolling pattern.

F. Sampling and Testing.

1. Production Sampling.

a. Mixture Sampling. The Engineer will obtain mixture samples in accordance with TxDOT standard laboratory test procedure Tex-222-F at a minimum frequency of one test every 2,000 tons produced and placed or each days production and placement quantity if less.

2. Production Testing. The Engineer will perform production tests.

a. Operational Tolerances. The Engineer will determine compliance with operational tolerances. The gradation of the aggregate must be within the master grading limits for the specified grade except that a tolerance of 2 percentage points is allowed on the sieve size for each mixture grade that shows 100% passing in Table 2.

Ensure that the asphalt content does not vary by more than 0.5 percentage points from the design target.

b. Individual Loads of Asphalt-Treated Base. The Engineer retains the right to reject individual truckloads of asphalt-treated base when it is evident that the material quality is unacceptable. When a load is rejected for reasons other than temperature, the Contractor may request that the rejected load be tested. Make this request within 4 hours of rejection. If City test results are within the operational tolerances listed in Section 292.4.F.2.a, “Operational Tolerances,” payment will be made for the load. If City test results are not within operational tolerances, no payment will be made for the load.

3. Placement Sampling and Testing. Obtain two 6 inch diameter cores side by side at locations selected by the Engineer for every 2,000 tons produced and placed or each days production and placement quantity if is less. Provide the Engineer an opportunity to witness the coring operation and measure the core thickness. Mark the cores for identification. Immediately after obtaining the cores, dry the core holes and tack the sides and bottom. Fill the hole with the same type of mixture and properly compact the mixture. Other methods of repairing the core holes are allowed when approved. Trim the cores, if necessary, and deliver them to the Engineer within 1 working day following placement operations unless otherwise approved.

a. In-Place Air Voids. The Engineer will measure in-place air voids in accordance with TxDOT standard laboratory test procedures Tex-207-F and Tex-227-F to verify that in-place density requirements of Section 206.4.E.1, “Density Control,” are met.

b. Irregularities. Remove and replace, at the expense of the Contractor and to the satisfaction of the Engineer, any mixture that does not bond to the existing pavement or has other surface irregularities identified by the Engineer. Correct grade deviations greater than ¼ inch in 16 feet measured longitudinally or greater than ¼ inch over the entire width of the cross-section, as shown on the plans.

c. Production Binder Properties. The Engineer may take cores or other production samples at random from the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Engineer. The aging ratio, as determined in accordance with laboratory test procedure AASHTO T-315, is the

DSR value of the extracted binder divided by the DSR value of the original unaged binder. The binder from RAP will be included proportionally as part of the original unaged binder. The Engineer may require the defective material be removed and replaced at the Contractor's expense. The asphalt binder will be recovered for testing from cores in accordance with TxDOT standard laboratory test procedure Tex-211-F.

G. Surface Finish. Use Surface Test Type A in accordance with TxDOT Standard Specification Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

H. Opening to Traffic. Open the completed course to traffic when permitted or directed. If the surface ravels, flushes, ruts, or deteriorates in any manner before final acceptance, correct it at the Contractor's expense and to the satisfaction of the Engineer.

END OF SECTION

SECTION 02712

CEMENT STABILIZED BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foundation course of cement stabilized crushed stone.

B. Foundation course of cement stabilized bank run gravel.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for cement stabilized base course is on square yard basis. Separate pay items are used for each different required thickness of base course.

2. Payment for asphaltic seal cure is by gallon.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

4. Refer to Paragraph 3.09, Unit Price Adjustment.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in Los Angeles Machine.

B. ASTM C 150 - Standard Specification for Portland Cement.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400-Ft-lb/ft3 (600kN kN-m/m3).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

H. TxDOT Tex-110-E - Particle Size Analysis of Soils.

I. TxDOT Tex-120-E - Soil-Cement Testing.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit samples of crushed stone, gravel, and soil binder for testing.

C. Submit manufacturer's description and characteristics for pug mill and associated equipment, spreading machine, and compaction equipment for approval.

1.05 TESTS

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform tests and analysis of aggregate and binder materials in accordance with ASTM D 1557 and ASTM D 4318.

1.06 DELIVERY, STORAGE AND HANDLING

A. Make stockpiles from layers of processed aggregate to eliminate segregation of materials. Load material by making successive vertical cuts through entire depth of stockpile.

B. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 PRODUCTS

2.01 CEMENT

A. ASTM C 150 Type I; bulk or sacked.

2.02 WATER

A. Clean, clear; and free from oil, acids, alkali, or vegetable matter.

2.03 AGGREGATE

A. Crushed Stone: Material retained on No. 40 Sieve meeting following requirements:

1. Durable particles of crusher-run broken limestone, sandstone, or granite obtained from approved source.

2. Los Angeles abrasion test percent of wear not to exceed 40 when tested in accordance with ASTM C 131.

B. Gravel: Durable particles of bank run gravel or processed material.

C. Soil Binder: Material passing No. 40 Sieve meeting following requirements when tested in accordance with ASTM D 4318:

1. Maximum Liquid limit: 35.

2. Maximum Plasticity index: 10.

D. Mixed aggregate and soil binder shall meet the following requirements:

1. Grading in accordance with TxDOT Tex-101-E and Tex-110-E within the following limits:

Sieve	Percent Retained Crushed Stone	Percent Retained G. 1	Percent Retained G. 2	Percent Retained Gravel
1 ¾ inch	0 to 10	0 to 5	-	0 to 5
½ inch	-	-	0	-
No. 4	45 to 75	30 to 75	15 to 35	30 to 75
No. 40	55 to 80	60 to 85	55 to 85	65 to 85

2. Obtain prior permission from Public Works for use of additives to meet above requirements.

2.04 ASPHALT SEAL CURE

A. Cutback Asphalt: MC30 conforming to requirements of Section 02742 - Prime Coat.

B. Emulsified Petroleum Resin: EPR-1 Prime conforming to requirements of Section 02742 - Prime Coat.

2.05 MATERIAL MIX

A. Design mix for minimum average compressive strength of 200 psi at 48 hours using TxDOT Tex-120-E unconfined compressive strength testing procedures. Provide minimum cement content of 1 1/2 sacks, weighing 94 pounds each, per ton of mix.

B. Increase cement content when average compressive strength of tests on field samples fall below 200 psi. Refer to Part 3 concerning field samples and tests.

C. Mix in stationary pug mill equipped with feeding and metering devices for adding specified quantities of base material, cement, and water into mixer. Dry mix base material and cement sufficiently to prevent cement balls from forming when water is added.

D. Resulting mixture shall be homogeneous and uniform in appearance.

2.06 SOURCE QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform testing for unconfined compressive strength by TxDOT Test Method Tex- 120-E as follows:

1. Mold three samples each day or for each 300 tons of production.

2. Compressive strength shall be average of three tests for each production lot.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation.

C. Correct subgrade deviations in excess of plus or minus ¼-In. in cross section or in 16-Ft. length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course for efficient operations.

3.03 PLACEMENT

A. Do not mix and place cement stabilized base when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Place material on prepared subgrade in uniform layers to produce thickness indicated on Drawings. Depth of layers shall not exceed 6-In.

C. Spread with approved spreading machine. Conduct spreading so as to eliminate planes of weakness or pockets of non-uniformly graded material resulting from hauling and dumping operations.

D. Provide construction joints between new material and stabilized base that has been in place 4 hours or longer. Joints shall be approximately vertical. Form joint with temporary header or make vertical cut of previous base immediately before placing subsequent base.

E. Use only one longitudinal joint at center line under main lanes and shoulder unless shown otherwise on Drawings. Do not use longitudinal joints under frontage roads and ramps unless indicated on Drawings.

F. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Secure firm bond between reinforcement and base.

3.04 COMPACTION

A. Start compaction as soon as possible but not more than 60 minutes from start of moist mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow stabilized base to mix with underlying material.

B. Correct irregularities or weak spots immediately by replacing material and recompacting.

C. Apply water to maintain moisture between optimum and 2 percent above optimum moisture as determined by ASTM D 698. Mix in with spiked tooth harrow or equal. Reshape surface and lightly scarify to loosen imprints made by equipment.

D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers which are sufficiently light to prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

F. Compact to minimum density of 95 percent of maximum dry density at moisture content of treated material between optimum and 2 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings.

G. Maintain surface to required lines and grades throughout operation.

3.05 CURING

A. Moist cure for minimum of 7 days before adding pavement courses. Restrict traffic on base to local property access. Keep subgrade surface damp by sprinkling.

B. If indicated on Drawings, cover base surface with curing membrane as soon as finishing operation is complete. Apply with approved self-propelled pressure distributor at following rates, or as indicated on Drawings:

1. MC30: 0.1 gallon per square yard.

2. EPR-1 Prime: 0.15 gallon per square yard.

C. Do not use cutback asphalt during period of April 16 to September 15.

3.06 TOLERANCES

A. Smooth and conform completed surface to typical section and established lines and grades.

B. Top surface of base course: Plus or minus 1 ¼-In. in cross section, or in 16-Ft. length.

3.07 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Take minimum of one core at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.

C. Request additional cores in vicinity of cores indicating nonconforming in-place depths at no extra cost to the City. When average of tests fall below required depth, place additional material and compact at no additional cost to the City.

D. Perform compaction testing in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017 at randomly selected locations. Remove and replace areas that do not conform to compaction requirements at no additional cost to the City.

E. Fill cores and density test sections with new compacted cement stabilized base.

3.08 NONCONFORMING BASE COURSE

A. Remove and replace areas of base course found deficient in thickness by more than 10 percent, or that fail compressive strength tests, with cement-stabilized base of thickness shown on Drawings.

B. Replace nonconforming base course sections at no additional cost to the City.

3.09 UNIT PRICE ADJUSTMENT

A. Make unit price adjustments for in-place depth determined by cores as follows:

1. Adjusted unit price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price.

2. Apply adjustment to lower limit of 90 percent and upper limit of 100 percent of unit price.

3.10 PROTECTION

A. Maintain stabilized base in good condition until completion of work. Repair defects immediately by replacing base to full depth.

B. Protect asphalt membrane, when used, from being picked up by traffic. Membrane may remain in place when proposed surface courses or other base courses are to be applied.

END OF SECTION

SECTION 02713

FLEXIBLE BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This item governs furnishing and placing a crushed stone base course for surfacing, pavement, or other base courses. “Flexible Base" shall be constructed on an approved, prepared surface in one or more courses conforming to the typical sections and to the lines and grades, indicated on the Drawings or established by the Engineer or designated representative.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Measurement for flexible base is for type and grade on a square yard basis complete in-place as described in the Contract Documents. Separate measurement will be made for each different required thickness of base course.

2. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, spreading, blading, mixing, shaping, placing, compacting, reworking, finishing, correcting locations where thickness is deficient, curing, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals

3. Refer to Section 01290 - Payment Procedures for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 1556 - Density of Soil in Place by the Sand-Cone Method.

B. TXDOT Test Method TEX-113-E.

C. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 361 - Test Method for Water Content of Soils and Rock in Place by Nuclear Methods (shallow depth).

E. ASTM D 3017 - Test Method for Water Content of Soils and Rock in Place by Nuclear Methods.

F. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

H. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittals Procedures.

B. Source, gradation and test results for the crushed limestone material. Upon request submit samples of flexible base course and soil binder for testing.

1.05 TESTS

A. Tests and analysis of soil materials will be performed in accordance with ASTM C 131, ASTM D 698, ASTM D 4318, Tex-114-E, Tex-101-E, and Tex-110-E under provisions of Section 01454 - Testing Laboratory Services.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide materials from stockpiles that are protected during storage from contaminates that would be detrimental to the flexible base course.

B. Load materials from same area of stockpile to maintain uniformity of each successive delivery to the project site.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer may sample and test project materials at any time before compaction throughout the duration of the project to assure specification compliance. Use the TxDOT standard laboratory test procedure Tex-100-E for material definitions.

B. Aggregate. Furnish aggregate of the type and grade shown on the plans and conforming to the requirements of Table 1. Each source must meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified. Do not use additives such as, but not limited to, lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1, unless shown on the plans.

Table 1 Aggregate Material Requirements

Property	Test Method[1]	Grade 1	Grade 2	Grade 3	Grade 4
Master gradation sieve size (% retained)	Tex-110-E				As shown on the plans
2-½ in		-	0	0	
1-¾ in		0	0-10	0-10	
⅞ in		10–35	-	-	
⅜ in		30–50	-	-	
No. 4		45–65	45–75	45–75	
No. 40		70–85	60–85	50–85	
Liquid limit, % max.[2]	Tex-104-E	35	40	40	As shown on the plans
Plasticity index, max.[2]	Tex-106-E	10	12	12	As shown on the plans
Plasticity index, min.[2]		As shown on the plans			
Wet ball mill, % max[3]	Tex-116-E	40	45	-	As shown on the plans
Wet ball mill, % max. increase passing the No. 40 sieve[3]		20	20	-	

1. TxDOT standard laboratory test procedures
2. Determine plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
3. ASTM C131 (Grad. A), Los Angeles Abrasion, can be used in lieu of the wet ball mill procedure. The maximum abrasion allowed to the crushed stone is forty (40) when subjected to the Los Angeles Abrasion test.

1. Material Tolerances. The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation. When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4 sieve.

   a. The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

2. Material Types. Do not use fillers or binders unless approved by the Engineer. Furnish the type specified on the plans in accordance with the following.

   a. Type A. 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. Type B. Crushed or uncrushed gravel. Blending of 2 or more sources is allowed. Use of this material must have written approval by the City Engineer prior to selection for bidding or construction.

   c. Type C. 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 TxDOT's standard laboratory test procedure Tex-460-A, Part I. Blending of 2 or more sources is allowed.

   d. Type D. Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete must meet the requirements in Section 2.01.A.3.b, "Recycled Material (Including Crushed Concrete) Requirements," and be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.

   e. Type E. As shown on the plans.

3. Recycled Material. Recycled asphalt pavement (RAP) and other recycled materials may be used when shown on the plans. Request approval to blend 2 or more sources of recycled materials.

   a. Limits on Percentage. When RAP is allowed, do not exceed 20% RAP by weight unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans.

   b. Recycled Material (Including Crushed Concrete) Requirements.

      1) Contractor Furnished Recycled Materials. When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of Table 1 for the grade specified. Certify compliance with TxDOT's DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines," for Contractor furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and

have at most 1.5% deleterious material when tested in accordance with TxDOT's standard laboratory test procedure Tex-413-A. For RAP, do not exceed a maximum percent loss from decantation of 5.0% when tested in accordance with TxDOT's standard laboratory test procedure Tex-406-A. Test RAP without removing the asphalt.

2) City Furnished Required Recycled Materials. When the City furnishes and requires the use of recycled materials, unless otherwise shown on the plans:

a) City required recycled material will not be subject to the requirements in Table 1,

b) Contractor furnished materials are subject to the requirements in Table 1 and this Item,

c) the final product, blended, will be subject to the requirements in Table 1, and

d) for final product, unblended (100% City furnished required recycled material), the liquid limit, plasticity index, wet ball mill, classification, and compressive strength is waived. Crush City-furnished RAP so that 100% passes the 2 inch sieve. The Contractor is responsible for uniformly blending to meet the percentage required.

3) City Furnished and Allowed Recycled Materials. When the City furnishes and allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of Table 1 and the plans.

c. Recycled Material Sources. City-owned recycled material is available to the Contractor only when shown on the plans. Return unused City-owned recycled materials to the City stockpile location designated by the Engineer unless otherwise shown on the plans.

d. The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Remove Contractor-owned recycled materials from the project and dispose of them in accordance with federal, state, and local regulations before project acceptance. Do not intermingle Contractor-owned recycled material with City-owned recycled material unless approved by the Engineer.

C. Water. Furnish water free of industrial wastes and other objectionable matter.

D. Material Sources. Only commercial sources may be used unless otherwise allowed by the City and shown on the plans.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify lines and grades are correct

3.02 EQUIPMENT:

A. Provide machinery, tools, and equipment necessary for proper execution of the work. Provide proof rollers in accordance with TxDOT Item 216, “Proof Rolling,” when required.

3.03 CONSTRUCTION:

A. Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

B. Stockpile base material temporarily at an approved location before delivery to the roadway. Build stockpiles in layers no greater than 2 feet thick. Stockpiles must have a total height between 10 and 16 feet unless otherwise shown on the plans. After construction and acceptance of the stockpile, loading from the stockpile for delivery is allowed. Load by making successive vertical cuts through the entire depth of the stockpile.

C. Do not add or remove material from temporary stockpiles that require sampling and testing before delivery unless otherwise approved. Charges for additional sampling and testing required as a result of adding or removing material will be deducted from the Contractor’s estimates.

D. Haul approved flexible base in clean trucks. Deliver the required quantity to each 100 foot station or designated stockpile site as shown on the plans. Prepare stockpile sites as directed. When delivery is to the 100 foot station, manipulate in accordance with the applicable Items.

3.04 PREPARATION OF SUBGRADE OR EXISTING BASE.

A. Remove or scarify existing asphalt concrete pavement in accordance with Section 02315, “Street Excavation,” when shown on the plans or as directed. Shape the subgrade or existing base to conform to the typical sections shown on the plans or as directed.

B. When new base is required to be mixed with existing base, deliver, place, and spread the new flexible base in the required amount per station. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

C. When shown on the plans or directed, proof roll the roadbed in accordance with TxDOT Item 216, “Proof Rolling,” before pulverizing or scarifying. Correct soft spots as directed.

3.05 PLACING.

A. Spread and shape flexible base into a uniform layer with an approved spreader the same day as delivered unless otherwise approved. Construct layers to the thickness shown on the plans. Maximum lift thickness shall be 8 inches of loose material. Maintain the shape of the course. Control dust by sprinkling, as directed. Correct or replace segregated areas as directed, at no additional expense to the City.

B. Place successive base courses and finish courses using the same construction methods required for the first course.

3.06 COMPACTION.

A. Compact in courses not to exceed 6 inches compacted depth using density control unless otherwise shown on the plans. Multiple lifts are permitted when shown on the plans or approved. Bring each layer to the moisture content directed. When necessary, sprinkle the material in accordance with TxDOT Item 204, “Sprinkling.”

B. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least ½ the width of the roller unit. On superelevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph as directed.

C. Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted. Continue work until

specification requirements are met. Perform the work at no additional expense to the City.

1. Ordinary Compaction. Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing approved material as required, reshaping, and recompacting.

2. Density Control. Compact to at least 95% of the maximum density determined by TxDOT's standard laboratory test procedure Tex-113-E unless otherwise shown on the plans. Determine the moisture content of the material at the beginning and during compaction in accordance with TxDOT's standard laboratory test procedure Tex-103-E.

   a. The Engineer will determine roadway density of completed sections in accordance with TxDOT's standard laboratory test procedure Tex-115-E. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pounds per cubic foot below the specified density.

3.07 FINISHING.

A. After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately ¼ inch. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the plans or as directed.

B. In areas where surfacing is to be placed, correct grade deviations greater than ¼ inch in 16 feet measured longitudinally or greater than ¼ inch over the entire width of the cross-section. Correct by loosening, adding, or removing material. Reshape and recompact in accordance with Section 306, "Compaction."

3.08 CURING.

A. Cure the finished section until the moisture content is at optimum, plus or minus 3 percentage points, or as directed, before applying the next successive course or prime coat.

END OF SECTION

SECTION 2716

GEOGRID REINFORCEMENT FOR PAVEMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section shall cover work of furnishing and constructing geogrid reinforcement as specified hereinafter shown on the plans, or directed by the Engineer. The work shall include placement of the geogrid in general conformance to the line and grade shown on the plans and shall include the furnishing of the materials, and other incidentals necessary to maintain the geogrid in its required position until the completion of any other associated work items.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Measurement shall be made by the square yard of surface area as shown on the plans. No measurement will be made for lapping of material.

2. The work performed and materials furnished, as prescribed by this item, and measured as provided above under Measurement, will be paid for at the unit price bid for Geogrid Reinforcement. Payment shall be based on the type of geogrid specified, which price shall be full compensation for furnishing all labor, materials, freight, tools, shipment, and incidentals, and for doing all the work involved in placement of the grid, complete in place.

3. Refer to Section 01290 - Payment Procedures for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's name, style or catalog designation of product; and roll width and length. C

C. All shipments of geogrid shall be accompanied by a mill certificate or affidavit, signed by a legally authorized official from the company

manufacturing the geogrid certifying that the material meets all stated chemical, physical, and manufacturing requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. The geogrid shall be a single layer regular grid structure formed by drawing a continuous sheet of polypropylene material. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service and shall also be resistant to ultraviolet degradation, to damage under construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

1. The geogrid shall also conform in all respects to the property requirements listed in Table A. The value listed in Table A are minimum certified values and are equal to the mean value less three standard deviations, which reflect the desired 99% confidence level. These values are to be verified by an independent laboratory.

2. Geogrids not meeting the physical properties of Table A may not be directly submitted into the project design without prior written approval of the Engineer.

3. Material substitutions for geogrids not conforming to the physical requirements of Table A must be submitted with an alternative design proposal to the Engineer at least 7 days prior to bid opening.

4. Alternate design proposals must be accompanied by the test data from an approved laboratory verifying all design and index properties in accordance with the test methods of Table A. Performance data, which quantifies the structural contribution of the geogrid to the pavement structure, shall be submitted to the Engineer.

Table 1 TABLE A – PHYSICAL REQUIREMENTS

PROPERTY	TEST METHOD	UNITS	BX 1100	BX 1200
Geometry				
Aperture Size MD[1] CMD[1]	 I.D. Calipered[2] I.D. Calipered[2]	 in / (mm) in / (mm)	 1.00 / (25) 1.30 / (33)	 1.00 / (25) 1.30 / (33)
Open Area	COE Method[3] CW-02215	%	70	70
Rib Thickness Rib Shape	Calipered Observation	in / (mm) N/A	0.03 / (0.76) Rectangular or Square	0.05 / (1.27) Rectangular or Square
Structural Integrity				
Torsional Rigidity (Aperture Stability Modulus) @ 20 cm-kg	COE METHOD[4]	cm-kg/deg.	3.2[5]	6.5[5]
Flexural Rigidity (Stiffness) MD	ASTM D1388-96[6]	Mg-cm	250,000	750,000
Tensile Strength MD CMD True Initial Modulus (min.) MD CMD	 ASTM D6637-01[8] ASTM D6637-01[8] ASTM D6637-01[8] ASTM D6637-01[8]	 lb/ft / (kN/m) lb/ft / (kN/m) lb/ft / (kN/m) lb/ft / (kN/m)	 280 / (4.1) 450 / (6.6) 17,140 / (250) 27,420 / (400)	 410 / (6.0) 590 / (8.6) 27,420 / (400) 44,550 / (650)
Junction Strength MD CMD	 GRI GG2-87[7] GRI GG2-87[7]	 lb/ft lb/ft	 765 1170	 1080 1778
Junction Efficiency	GRI GG2-87[7]	%	93	93
Durability				
Resistance to Installation Damage	ASTM D5818	%SC/%SW/%GP	90/83/70	91/83/71
Resistance to Long Term Degradation	ASTM D5818 EPA 9090	%	100	100
Material				
Polypropylene	ASTM D4101 Group 1/ Class 1/ Grade 2	%	98	98
Carbon Black	ASTM 4218	%	0.5	0.5

- MD dimension is along roll length; CMD dimension is across roll width.
- Maximum inside dimensions in each principal direction measured by calipers.
- Percent Open area measured without magnification by Corps. Of Engineers method as specified in CW02215.
- Resistance to in-plane rotational movement measured by applying a 20cm-kg moment to the central junction of a 9" x 9" specimen restrained at its perimeter. (U.S. Army Corps of Engineers Methodology) & Grid Aperture Stability Test developed by Dr. T. Kinney at the University of Alaska, Fairbanks.
- Secant Aperture Stability Modulus. Value listed is equal to the mean value less approximately one standard deviation.
- ASTM D1388-96, Option A modified to account for wide specimen testing.
- Geotextile junction strength and junction efficiency measured by Geosynthetic Research Institute test method GRI-GG2-87 "Geotextile Junction Strength." Geogrid shall not be pre-tensioned prior to testing strength parameter.
- True resistance to elongation when initially subjected to a load measured using ASTM D6637 without deforming test materials under load before measuring such resistance or employing "secant" or "offset" tangent methods of measurement so as to overstate tensile properties. For single layer products use Test Method A, for multi-layer products use Test Method C.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. At the time of installation, the geogrid shall be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by the Engineer, the damaged sections may be repaired by patching the damaged area with an additional layer of geogrid 2' to 3' around the affected area.

3.02 CONSTRUCTION METHODS

A. Subgrade shall be prepared as indicated on the plans or as directed by the Engineer. The geogrid shall be installed in accordance with the lines and grades shown on the plans.

B. The geogrid shall be oriented such that the roll length runs parallel to the road direction. Geogrid sections shall be overlapped as indicated on the plans or as directed by the Engineer.

C. Minimum lap shall be one (1) foot, based on the strength of the subgrade, or as specified on the plans. Care shall be taken to ensure that geogrid sections do not separate at laps during construction. Placement of geogrid around corners will require cutting of the geogrid and diagonal lapping to ensure that excessive buckling of grid material does not occur.

D. Base material shall be placed in lift thickness as shown on the plans. Tracked construction equipment shall not operate directly upon the geogrid. A minimum fill thickness of six (6) inches is required prior to operation of tracked vehicles over the geogrid.

E. Rubber-tired equipment may pass over the geogrid at slow speeds of less than five (5) miles per hour, if the underlying material is capable of supporting the loads without rutting or causing damage to the geogrid. Sharp turning or sudden braking shall be prohibited. The Contractor shall be required to replace, at his expense, sections of the geogrid that are damaged, during construction.

F. If approved by the Engineer, geogrid may be placed directly under hot-mixed asphaltic concrete base in accordance with Section 02741 "Asphalt Concrete Pavement" The lift thickness of base material placed directly on the geogrid shall not be greater than 6 inches compacted. This material shall be back dumped from trucks riding on top of the reinforced base material and bladed on to the grid ahead.

END OF SECTION

SECTION 2741

ASPHALTIC CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface course and leveling-up course of compacted mixture of coarse and fine aggregates and asphaltic binder.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hot-mix asphalt concrete pavement is on a per ton basis, which price shall be full compensation for furnishing and placing all materials, and for all labor, tools, equipment, and incidentals necessary to complete the work. Separate pay items are used for each different required thickness of pavement.
2. Payment for hot-mix asphalt concrete pavement includes payment for associated work performed in accordance with Section 02743 - Tack Coat.
3. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.
4. Payment for temporary detour pavement is on a square yard basis and includes surface and base materials, associated grading, maintenance and removal as well as restoration of ditches.
5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates.

B. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils

D. TxDOT Tex-126-E - Molding, Testing, and Evaluating Bituminous Black Base Material.

E. TxDOT Tex-200-F - Sieve Analysis of Fine and Course Aggregates.

F. TxDOT Tex-203-F - Sand Equivalent Test.

G. TxDOT Tex-204-F - Design of Bituminous Mixtures.

H. TxDOT Tex 206-F - Compacting Test Specimens of Bituminous Mixtures.

I. TxDOT Tex-207-F - Determining Density of Compacted Bituminous Mixtures.

J. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

K. TxDOT Tex-217-F - Determining Deleterious Material and Decantation Test for Coarse Aggregates.

L. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.

M. TxDOT Tex-530-C - Effect of Water on Bituminous Paving Mixtures.

N. TxDOT Tex-531-C - Prediction of Moisture Induced Damage to Bituminous Paving Materials Using Molded Specimens.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certificates that asphalt materials and aggregates meet requirements of Paragraph 2.01, Materials.

C. Submit proposed design mix and test data for surface course.

D. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials used in Hot Mix Asphaltic Concrete Pavement shall meet the requirements as set forth herein. If shown on the plans, materials may also meet the requirements as described in TxDOT Item 340, “Dense-Graded Hot-Mix Asphalt (Method)” or TxDPT Item 341, “Dense-Graded Hot-Mix Asphalt (QC/QA)” of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges.

1. Unless otherwise shown on the plans, provide aggregates that meet the aggregate quality requirements of TxDOT’s Bituminous Rated Source Quality Catalog (BRSQC). Unapproved sources may be used if accepted by the Engineer and approved prior to use.

2. Furnish aggregates from sources that conform to the requirements shown in Table 1 herein, and as specified in this Section, unless otherwise shown on the plans. Provide aggregate stockpiles that meet the definition in this Section for either a coarse aggregate or fine aggregate. When reclaimed asphalt pavement (RAP) is used, provide RAP stockpiles in accordance with this Section. Aggregate from RAP is not required to meet Table 1 requirements unless otherwise shown on the plans.

3. Document all test results on a mixture design report and submit to the Engineer for approval. The Engineer may perform tests on independent or split samples to verify Contractor mix design results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in TxDOT standard laboratory test procedure Tex-200-F, Part II. Do not add material to an approved stockpile from other sources, unless otherwise approved by the Engineer.

4. Unless otherwise shown on the plans, reclaimed asphalt pavement (RAP) may be used in asphalt pavement maintenance or rehabilitation applications and shall be limited to a maximum of 20% RAP for surface or wearing courses and 30% RAP for courses below the surface or wearing course. Higher percentages of RAP may be used if requested in writing and approved by the Engineer prior to use.

B. Coarse Aggregate. Coarse aggregate stockpiles must have no more than 20% passing the #8 sieve. Provide aggregates with a surface aggregate classification (SAC) as shown below:

Street Classification	**Minimum Surface Aggregate Classification**
Primary and Secondary Arterials	A
Collector and Local Streets	B
Local Street Without Bus Traffic	C

1. SAC requirements apply only to aggregates used on the surface of travel lanes, unless otherwise shown on the plans. Blending aggregates to meet SAC criteria is allowable. Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate in order to meet requirements for Class A materials. When blending Class A and B aggregates to meet a Class A requirement, ensure that at least 50% by weight of the material retained on the No. 4 sieve comes from the Class A aggregate source. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. When blending, do not use Class C or D aggregates. For blending purposes, coarse aggregate from RAP will be considered as Class B aggregate.

C. Reclaimed Asphalt Pavement (RAP). RAP is defined as a salvaged, pulverized, broken or crushed asphalt pavement. The RAP to be used in the mix shall be crushed or broken to the extent that 100% will pass the two inch sieve. The stockpiled RAP shall not be contaminated by dirt or other objectionable materials. Unless otherwise shown on the plans, stockpiled, crushed RAP shall have a decantation of 5% or less and a plasticity index of eight (8) or less, when tested in accordance with TxDOT standard laboratory test procedures Tex-406-A, Part I, and Tex-106-E, respectively. This requirement applies to stockpiles from which the asphalt has not been removed by extraction. When RAP is used, determine asphalt content and gradation for mixture design purposes.

D. Fine Aggregate. Fine aggregates may consist of manufactured sands, screenings and field sands. Supply fine aggregates that are free from organic impurities. Field sands and other uncrushed aggregates shall be limited to 15% of the total aggregate.

1. If 10% or more of the fine aggregate stockpile is retained on the No. 4 sieve, test the stockpile and verify that it meets the requirements in Table 1 for coarse aggregate angularity (TxDOT standard laboratory test procedure Tex-460-A) and flat and elongated particles (TxDOT standard laboratory test procedure Tex-280-F).

E. Asphalt Binder. Unless shown on the plans, provide the type and grade of performance-graded asphalt binder in accordance with TxDOT Item 300.2.J. “Performance-Graded Binders” and as specified below:

Street Classification	**Minimum PG Asphalt Cement Grade**		
	Surface Courses	Binder & Level Up Courses	Base Courses
Primary and Secondary Arterials	PG 76-22	PG 70-22	PG 64-22
Collector and Local Streets	PG 70-22		
Local Street Without Bus Traffic	PG 64-22	PG 64-22	

F. Mineral Filler. Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, cement, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Do not use more than 2% hydrated lime or cement, unless otherwise shown on the plans. The plans may require or disallow specific mineral fillers. When used, provide mineral filler that:

1. is sufficiently dry, free-flowing, and free from clumps and foreign matter;
2. does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
3. meets the gradation requirements of Table 3 herein.

G. Baghouse Fines. Fines collected by the baghouse or other dust collecting equipment may be reintroduced into the mixing drum.

H. Tack Coat. Unless otherwise shown on the plans or approved, furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder and in accordance with Section 02743 "Tack Coat." Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

I. Additives. When shown on the plans, use the type and rate of additive specified. Other additives that facilitate mixing or improve the quality of the mixture may be allowed when approved. If lime or a liquid antistripping agent is used, add in accordance with TxDOT Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream, unless the plant has a baghouse or dust collection system that reintroduces the lime back into the drum.

Table 1 Aggregate Quality Requirements

Property	TxDOT Standard Laboratory Test Procedure	Surface Courses	Binder, Level Up, & Base Courses
Course Aggregate			
Deleterious Material, %, max	Tex-217-F, Part I	1.0	1.5
Decantation, %, max	Tex-217-F, Part II	1.5	1.5
Micro-Deval Abrasion, %, max	Tex-461-A	Screening Only	Screening Only
Los Angeles Abrasion, %, max	Tex-410-A	35	40
Magnesium Sulfate Soundness, 5 cycles, %, max	Tex-411-A	25	30
Coarse Aggregate Angularity, 2 crushed faces, %, min	Tex-460-A, Part I	95[1]	85[1]
Flat and Elongated Particles @ 5:1, %, max	Tex-280-F	10	10
Fine Aggregate			
Linear Shrinkage, %, max	Tex-107-E	3	3
Combined Aggregate[2]			
Sand Equivalent, %, min	Tex-203-F	45	45

Note 1: Applies to Gravel Only
Note 2: Aggregate without mineral filler, RAP, or additives combined as used in the job-mixed formula (JMF)

Table 2 Gradation Requirements for Fine Aggregate

Sieve Size, in	% Passing by Weight or Volume
3/8	100
#8	70-30
#200	0-30

Table 3 Gradation Requirements for Mineral Filler

Sieve Size, in	% Passing by Weight or Volume
#8	100
#200	55-100

2.02 EQUIPMENT:

All equipment for the handling of all materials, mixing, placing and compacting of the mixture shall be maintained in good repair and operating condition and subject to the approval of the Engineer. Any equipment found to be defective and potentially having a negative effect on the quality of the paving mixture or ride quality will not be allowed.

B. Spreading and Finishing Machine. The spreading and finishing machine shall be approved by the Engineer and shall meet the requirements indicated below.

1. Screed Unit. The spreading and finishing machine shall be equipped with a heated compacting screed. It shall produce a finished surface meeting the requirements of the typical cross sections and the surface test.

a. Extensions added to the screed shall be provided with the same compacting action and heating capability as the main screed unit, except for use on variable depth tapered areas and/or as approved by the Engineer.

b. The spreading and finishing machine shall be equipped with an approved automatic dual longitudinal screed control system and automatic transverse screed control system. The longitudinal controls shall be capable of operating from any longitudinal grade reference including a stringline, ski, mobile stringline, or matching shoe.

c. The Contractor shall furnish all equipment required for grade reference. It shall be maintained in good operating condition by personnel trained in the use of this type of equipment.

d. The grade reference used by the Contractor may be of any type approved by the Engineer. The contractor shall set the grade reference to have sufficient support so that the maximum deflection shall not exceed 1/16 inch between supports.

2. Tractor Unit. The tractor unit shall be equipped with a hydraulic hitch sufficient in design and capacity to maintain contact between the rear wheels of the hauling equipment and the pusher rollers of the finishing machine while the mixture is being unloaded.

a. No portion of the weight of hauling equipment, other than the connection, shall be supported by the asphalt paver. No vibrations or other motions of the loading equipment, which could have a detrimental effect on the riding quality of the completed pavement, shall be transmitted to the paver.

b. The use of any vehicle which requires dumping directly into the finishing machine and which the finishing machine cannot push

or propel to obtain the desired lines and grades without resorting to hand finishing will not be allowed.

C. Material Transfer Equipment. Equipment to transfer mixture from the hauling units or the roadbed to the spreading and finishing machine will be allowed unless otherwise shown on the plans. A specific type of material transfer equipment shall be required when shown on the plans.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. It shall be the responsibility of the Contractor to design, produce, transport, place and compact the specified paving mixture in accordance with the requirements herein. The Engineer will perform verification testing as needed. Provide quality control (QC) testing as needed to meet the requirements of this Item. Provide a certified Level I-A specialist at the plant during production hours. Provide a certified Level I-B specialist to conduct placement tests.

3.02 QUALITY CONTROL PLAN (QCP)

B. Unless otherwise shown on the plans, develop and follow a QCP. Obtain approval from the Engineer for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP. Submit a written QCP to the Engineer and receive the Engineer's approval of the QCP before beginning production. Include the following items in the QCP.

1. Project Personnel. Provide:
   a. list of individuals that will conduct tests as well their associated certifications (i.e. Level IA, IB, and II certifications), including when certifications will expire for each individual; and
   b. a list of individuals responsible for QC with authority to take corrective action and the contact information for each individual listed.
2. Material Delivery and Storage. Provide:
   a. the sequence of material processing, delivery, and minimum quantities to assure continuous plant operations;
   b. aggregate stockpiling procedures to avoid contamination and segregation;
   c. frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
   d. procedure for monitoring the quality and variability of asphalt binder.
3. Production. Detail:

a. loader operation procedures to avoid contamination in cold bins;

b. procedures for calibrating and controlling cold feeds;

c. procedures to eliminate debris or oversized material;

d. procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, RAP, lime, liquid antistrip);

e. procedures for reporting job control and acceptance test results; and

f. procedures to avoid segregation and drain-down in the silo.

4. Loading and Transporting. Provide:

a. the type and application method for release agents; and

b. truck loading procedures to avoid segregation.

5. Placement and Compaction. Provide:

a. the proposed agenda for mandatory pre-paving meeting including date and location;

b. the type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;

c. procedures for the transfer of mixture into the paver while avoiding segregation and preventing material spillage;

d. the process to balance production, delivery, paving, and compaction to achieve continuous placement operations;

e. the paver operations (e.g., operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and

f. procedures to construct quality longitudinal and transverse joints.

3.03 MIXTURE DESIGN

C. Use a Level II specialist certified by a TxDOT-approved hot-mix asphalt certification program to develop the mixture design. Have the Level II specialist sign the design documents. Unless otherwise shown on the plans, use the typical weight design example given in TxDOT standard laboratory test procedure Tex-204-F, Part I or Part III, to design a mixture meeting the requirements listed in Tables 1 through 5. At the request of the Engineer, furnish representative samples of all materials used in the mixture design for verification. If the design cannot be verified by the Engineer, furnish another mixture design.

1. The Contractor may submit a new mixture design at anytime during the project. The Engineer will approve all mixture designs before the Contractor can begin production.

2. Provide the Engineer with a mixture design report that includes the following items:

   a. the combined aggregate gradation, source, specific gravity, and percent of each material used;

   b. results of all applicable tests;

   c. the mixing and molding temperatures;

   d. all applicable correlation and correction factors;

   e. the signature of the Level II person or persons who performed the design;

   f. the date the mixture design was performed; and

   g. a unique identification number for the mixture design.

3. The Hamburg Wheel Test is not required, unless otherwise shown on the plans. When required through plan note, the minimum number of passes shown in Table 6 shall be met, unless otherwise approved by the Engineer. The contractor will be responsible for submitting the results of the Hamburg Wheel test to the Engineer with the other mixture design data. Use an approved laboratory to perform the Hamburg Wheel test. The TxDOT Construction Division maintains a list of approved laboratories that may be referenced. Hamburg Wheel Testing will not be performed or required for any Type "F" mixtures.

Table 4 Master Gradation Bands (% Passing by Weight or Volume) and Volumetric Properties

Sieve Size	A Coarse Base	B Fine Base	C Coarse Surface	D Fine Surface	F Fine Mixture
1-½"	98.0–100.0	-	-	-	-
1"	78.0–94.0	98.0–100.0	-	-	-
¾"	64.0–85.0	84.0–98.0	95.0–100.0	-	-
½"	50.0–70.0	-	-	98.0–100.0	-
⅜"	-	60.0–80.0	70.0–85.0	85.0–100.0	98.0–100.0
#4	30.0–50.0	40.0–60.0	43.0–63.0	50.0–70.0	70.0-90.0
#8	22.0–36.0	29.0–43.0	32.0–44.0	35.0–46.0	35.0–50.0
#30	8.0–23.0	13.0–28.0	14.0–28.0	15.0–29.0	12.0–27.0
#50	3.0–19.0	6.0–20.0	7.0–21.0	7.0–20.0	6.0–19.0
#200	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0
Design Voids in the Mineral Aggregate (VMA), % minimum					
	12.0	13.0	14.0	15.0	16.0
Plant-Produced Voids in the Mineral Aggregate (VMA), % minimum					
	11.0	12.0	13.0	14.0	15.0

Table 5 Laboratory Mixture Design Properties

Property	TxDOT Standard Laboratory Test Procedure	Required	
Target laboratory molded density, %	Tex-207-F	96.5	Base, Binder, and Level Up Courses
		Surface or Wearing Courses	
		96.5	Primary and Secondary Arterials
		97.0	Collectors, Local Streets
		97.5	Local Streets no bus traffic
Boil test[1]	Tex-530-C		

1 Used to establish baseline for comparison to production results. May be waived when approved.

Table 6 Hamburg Wheel Test Requirements[1]

High-Temperature Binder Grade	Minimum # of Passes[2] @ 0.5" Rut Depth, Tested @ 122°F
PG 64 or lower	5,000
PG 70	10,000
PG 76 or higher	20,000

1 Tested in accordance with Tex-242-F.
2 May be decreased if shown on the plans.

3.04 JOB-MIX FORMULA

A. The laboratory mixture design shall be submitted to the Engineer for approval prior to production and placement. The submittal shall provide the laboratory designed mixture target properties and data that demonstrate the contractor's ability to produce the mixture within the tolerances specified in Table 7 herein either through a trial batch or by submittal of previous production data from a City or TxDOT project.

1. Once approved, the contractor may begin production and placement of the approved JMF. Results from Lot 1 of the JMF may be used to modify the optimum mixture properties as long as the tested properties are within the tolerances specified in Table 7 herein. Further adjustments to the JMF may be allowed by the Engineer during production and placement, if warranted. JMF adjustment requests must be made in writing to the Engineer and the mixture must conform to the master gradation limits for the mixture type and be within the operational limits of Table 7 noted above for the initial JMF approved by the Engineer.

2.

Table 7 Operational Tolerances

Description	Test Method	Allowable Difference from Current JMF Target
Individual % Retained for #8 Sieve or Larger	Tex-200-F or Tex-236-F	±5.0[1]
Individual % Retained for Sieves Smaller than #8 and Larger than #200		3.0[1]
% Passing the #200 Sieve		2.0[1]
Asphalt Content, %	Tex-236-F	±0.3[2]
Laboratory-Molded Density, %	Tex-207-F	±1.0
VMA, % minimum		Note 3

Note 1: When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 sieve will be considered out of tolerance when outside the master grading limits.
Note 2: Tolerance between Laboratory Mix and Plant Trial Batch may exceed ±0.3.
Note 3: Test and verify that Table 4 requirements are met.

3.05 PRODUCTION

A. Do not heat the asphalt binder above the temperatures specified in TxDOT Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Do not store an asphaltic mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr.

1. Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F. The Engineer will not pay for, or allow placement of, any mixture produced at more than 350°F. Control the mixing time and temperature so that moisture is removed from the mixture before discharging from the plant. If requested, determine the moisture content by oven-drying in accordance with TxDOT standard laboratory test procedure Tex-212-F, Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck, and perform the test promptly.

2. Perform a new trial batch when the plant or plant location is changed. The Engineer may suspend production for noncompliance with this Item. Take corrective action and obtain approval to proceed after any production suspension for noncompliance.

B. Tack Coat. The surface upon which the tack coat is to be placed shall be cleaned thoroughly to the satisfaction of the Inspector. The surface shall be given a uniform application of tack coat using asphaltic materials of this specification. Unless otherwise shown on the plans, coat shall be applied with an approved sprayer at a rate directed by the Engineer between and 0.10 gallon residual asphalt per square yard of surface.

C. Transporting Asphaltic Concrete. The asphaltic mixture shall be hauled to the work site in vehicles previously cleaned of all foreign material and with beds that do not discharge or lose materials during the haul. Trucks that do not meet the satisfaction of the Engineer or Inspector will not be allowed to deliver materials to City projects. The dispatching of the vehicles shall be arranged so that all material is delivered, placed, and rolled during daylight hours unless otherwise shown on the plans. In cool weather, or for long hauls, covering and insulating of the truck bodies may be required. If necessary, to prevent the mixture from adhering to the inside of the truck body, the inside of the truck may be given a light coating of release agent satisfactory to the Engineer.

3.06 PLACEMENT

A. Weather Conditions. Place mixture, when placed with a spreading and finishing machine, or the tack coat when the roadway surface temperature is 60°F or higher unless otherwise approved. Measure the roadway surface temperature with a handheld infrared thermometer. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.

1. The asphaltic mixture, when placed with a motor grader, shall not be placed when the surface temperature is below 65°F and is falling, but may be placed when the surface temperature is above 55°F and is rising. The maximum depth of asphalt mixture placed with a motor grader will not exceed 5 inches of compacted material.

2. Mat thicknesses of 1-½ inches and less shall not be placed when the temperature of the surface on which the mat is to be placed is below 60°F. It is further provided that the tack coat or asphaltic mixture shall be placed only when the humidity, general weather conditions, temperature and moisture condition of the base are suitable.

B. Placement Temperature. If, after being discharged from the mixer and prior to placing, the temperature of the asphaltic mixture falls below 200°F, all or any part of the load may be rejected and payment will not be made for the rejected material.

C. Placement Operations. Placement and laydown operations shall be in conformance with this section and section 3.01.H. - “Quality Control and Acceptance.”

1. Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges.

2. The asphaltic mixture shall be dumped and spread on the approved prepared surface with the spreading and finishing machine. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. In addition, the placing of the asphaltic mixture shall be completed without tearing, shoving, gouging or segregating the mixture and without producing streaks in the mat.

3. Unloading into the finishing machine shall be controlled so that bouncing or jarring the spreading and finishing machine shall not occur and the required lines and grades shall be obtained without resorting to hand finishing.

4. When approved by the Engineer, level-up courses may be spread with a motor grader.

5. Construction joints of successive courses of asphaltic material shall be offset at least 6 inches. Construction joints on surface courses shall coincide with lane lines, or as directed by the Engineer.

6. The spreading and finishing machine shall be operated at a uniform forward speed consistent with the plant production rate, hauling capability, and roller train capacity to result in a continuous operation. The speed shall be slow enough that stopping between trucks is not ordinarily required. If, in the opinion of the Inspector, sporadic delivery of material is adversely affecting the mat, the Inspector may require paving operations to cease until acceptable methods are provided to minimize starting and stopping of the paver.

7. The hopper flow gates of the spreading and finishing machine shall be adjusted to provide an adequate and consistent flow of material. These shall result in enough material being delivered to the augers so that they are operating approximately 85 percent of the time or more. The augers shall provide means to supply adequate flow of material to the center of the paver. Augers shall supply an adequate flow of material for the full width of the mat, as approved by the Engineer. Augers should be kept approximately one-half to three-quarters full of mixture at all times during the paving operation.

8. When the asphaltic mixture is placed in a narrow strip along the edge of an existing pavement, or used to level up small areas of an existing pavement, or placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated when authorized by the Engineer.

9. Adjacent to flush curbs, gutters and structures, the surface shall be finished uniformly high so that when compacted, it will be slightly above the edge of the curb or structure.

10. If a pattern of surface irregularities or segregation is detected, the Contractor shall make an investigation into the causes and immediately take the necessary action. With the approval of the Inspector, placement may continue for no more than one full production day from the time the Contractor is first notified and while corrective actions are being taken. If the problem still exists after that time, paving shall cease until the Contractor further investigates the causes and the Engineer approves further corrective action to be taken.

11. Place mixture within the compacted lift thickness shown in Table 8, unless otherwise shown on the plans or allowed. Use the guidelines in Table 9 to establish the temperature of mixture delivered to the paver.

Table 8 Compacted Lift Thickness and Required Core Height

Mixture Type	Compacted Lift Thickness		Minimum Untrimmed Core Height (in.) Eligible for Testing
	Minimum (in.)	Maximum (in.)	
A	3.00	6.00	2.00
B	2.50	5.00	1.75
C	2.00	4.00	1.50
D	1.50	3.00	1.25
F	1.25	2.50	1.25

Table 9 Suggested Minimum Mixture Placement Temperature

High-Temperature Binder Grade	Minimum Placement Temperature (Before Entering Paver)
PG 64 or lower	260°F
PG 70	270°F
PG 76	280°F
PG 82 or higher	290°F

3.07 COMPACTION

D. The pavement shall be compacted thoroughly and uniformly with the necessary rollers to obtain the compaction and cross section of the finished paving mixture meeting the requirements of the plans and specifications.

1. The edges of the pavement along curbs, headers and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction with the rollers, shall be thoroughly compacted with lightly oiled tamps.

a. Rolling with a trench roller will be required on widened areas, in trenches and other limited areas where satisfactory compaction cannot be obtained with the approved rollers.

b. In-Place Compaction Control. Use density control unless ordinary compaction control is specified on the plans. Use the control strip method given in Tex-207-F, Part IV, to establish the rolling pattern for density controlled areas.

1) Where specific density or air void requirements are waived, furnish and operate compaction equipment as approved.

2) Do not use pneumatic-tire rollers if excessive pickup of fines by roller tires occurs. Unless otherwise directed, use only water or an approved release agent on rollers, tamps, and other compaction equipment. Keep diesel, gasoline, oil, grease, and other foreign matter off the mixture.

3) When rolling with the three-wheel, tandem or vibratory rollers, it is recommended that rolling start by first rolling the joint with the adjacent pavement and then continue by rolling longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least 1 foot. Alternate trips of the roller should be slightly different in length. On super-elevated curves, rolling should begin at the low side and progress toward the high side.

4) When rolling with vibratory steel-wheel rollers, equipment operation shall be in accordance with TxDOT Item 210, “Rolling”, and the manufacturer's recommendations, unless otherwise directed by the Engineer. Vibratory rollers shall not be left vibrating while not rolling or when changing directions. In addition, vibratory rollers shall not be allowed in the vibrating mode on mats with a plan depth of less than 1-½ inches, unless approved by the Engineer.

5) The motion of the rollers shall be slow enough to avoid other than usual initial displacement of the mixture. If any displacement occurs, it shall be corrected to the satisfaction of the Inspector. Ensure pavement is fully compacted before allowing rollers to stand on the pavement.

6) Ordinary Compaction Control. One three-wheel roller, one pneumatic-tire roller, and one tandem roller shall be furnished for each compaction operation except as provided below or approved by the Engineer. The use of a tandem roller may be waived by the Engineer when the surface is already adequately smooth and further steel-wheel rolling is shown to be ineffective. With approval of the Engineer, the Contractor may substitute a vibratory roller for the three-wheel roller and/or the tandem roller. Use of at least one pneumatic-tire roller is required unless approved by the Engineer. Additional or heavier rollers shall be furnished if required by the Engineer.

Rolling patterns shall be established by the Contractor to achieve the maximum compaction. The selected rolling pattern shall be followed unless changes in the mixture or placement conditions occur which affect compaction. When changes in the mixture or placement conditions occur, a new rolling pattern shall be established.

7) Density Compaction Control. Place and compact asphaltic concrete materials in accordance with the method specified in this section 302.H, “Quality Control and Acceptance.”

2. Compaction Cessation Temperature. Regardless of the method required for in-place compaction control, all rolling for compaction shall be completed before the mixture temperature drops below 175°F.

3. Opening to Traffic. Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. When directed, sprinkle the finished mat with water or limewater to expedite opening the roadway to traffic.

a. If the surface ravels, flushes, ruts or deteriorates in any manner prior to final acceptance of the work, it will be the Contractor's responsibility to correct this condition at their expense, to the satisfaction of the Inspector and in conformance with the requirements of this specification.

3.08 QUALITY CONTROL AND ACCEPTANCE.

A. Control and acceptance of hot mixed asphaltic concrete pavement shall be followed as specified herein or as directed on the plans. The contractor shall conduct production and placement operations in accordance with the

method specified. All testing will be conducted in accordance with the testing methods shown in Table 10.

Table 10 Acceptable Production and Placement Testing Methods

Description	Test Method
Gradation including % passing the #200 sieve	Tex-200-F or Tex-236-F
Laboratory-molded density	Tex-207-F
VMA	
Laboratory-molded bulk specific gravity	
In-Place air voids	
Segregation (density profile)	Tex-207-F, Part V
Longitudinal joint density	Tex-207-F, Part VII
Moisture content	Tex-212-F, Part II
Theoretical maximum specific (Rice) gravity	Tex-227-F
Asphalt content	Tex-236-F
Hamburg Wheel test	Tex-242-F
Thermal profile	Tex-244-F
Asphalt binder sampling and testing[1]	Tex-500-C
Boil test[1]	Tex-530-C

1 The Engineer may waive the sampling and testing requirements at their discretion.

1. Production Sampling and Testing. For a given project, sample asphaltic concrete materials at the production facility every 500 tons for each mixture type supplied or as directed by the Engineer. Unless otherwise shown on the plans, a production facility that supplies the same mixture to multiple City projects on the same day will not be required to sample and test at the required frequency for every project. A single test report may be used on two or more projects to represent the quality of the mixture for that day's production.

   a. During production, do not exceed the operational tolerances in Table 7. Stop production if testing indicates tolerances are exceeded on:

      1) 3 consecutive tests on any individual sieve,

      2) 4 consecutive tests on any of the sieves, or

      3) 2 consecutive tests on asphalt content.

   b. Suspend production and shipment of mixture if the asphalt content deviates from the current JMF by more than 0.5% for any test.

c. Begin production only when test results or other information indicate, to the satisfaction of the Engineer, that the next mixture produced will be within Table 7 tolerances.

d. The Contractor shall perform a Hamburg Wheel test at the direction of the Engineer at any time during production, including when the boil test indicates a change in quality from the materials submitted for the initial JMF. If the production sample fails the Hamburg Wheel test criteria in Table 6, suspend production until further Hamburg Wheel tests meet the specified values. The Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor's expense.

e. If the Hamburg Wheel test results in a "remove and replace" condition, the Contractor may request that the Engineer confirm the results by retesting the failing material. An Independent laboratory retained by the Engineer will perform the Hamburg Wheel tests and determine the final disposition of the material in question based on the initial test results.

2. Placement Sampling and Testing.

a. In-Place Density. For every 500 tons of compacted asphaltic material or as directed by the Engineer, test the in place density. The in place density shall be in the range of 92.0% to 97.0% of the maximum density. Do not increase the asphalt content of the mixture to increase pavement density.

1) Unless otherwise shown on the plans, obtain 2 roadway specimens at each location selected by the Engineer for in-place density determination. Unless otherwise determined, the Engineer will witness the coring operation and measurement of the core thickness. Unless otherwise approved, obtain the cores within 1 working day after placement is completed. Obtain two 6 inch diameter cores side-by-side from within 1 foot of the location provided by the Engineer. For Type C, D and F mixtures, 4 inch diameter cores are allowed. Mark the cores for identification.

2) Visually inspect each core and verify that the current paving layer is bonded to the underlying layer. If an adequate bond does not exist between the current and underlying layer, take corrective action to insure that an adequate bond will be achieved during subsequent placement operations.

3) Immediately after obtaining the cores, dry the core holes and tack the sides and bottom. Fill the hole with the same type of mixture and properly compact the mixture. Repair core holes with other methods when approved.

4) If the core heights exceed the minimum untrimmed values listed in Table 8, trim the cores within 1 working day following placement operations unless otherwise approved. If the core height before trimming is less than the minimum untrimmed value shown in Table 8, decide whether or not to include the pair of cores in the density determination for that sublot. If the cores are to be included in density determination, trim the cores. If the cores will not be included in density determination, store untrimmed cores for the Engineer.

5) The Engineer will measure density in accordance with Tex-207-F and Tex-227-F. Before drying to a constant weight, cores may be pre-dried using a vacuum device, or by other methods approved by the Engineer, to remove excess moisture. The Engineer will use the average density of the 2 cores to calculate the in-place density at the selected location.

6) If the in-place density in the compacted mixture is below 92% or greater than 97%, change the production and placement operations to bring the in-place density within requirements. The Engineer may suspend production until the in-place density is brought to the required level, and may require a test section as described below, before proceeding.

7) At the onset of production, or after production and placement operations have been altered to bring the in-place density into conformance, construct a test section of 1 lane-width and at most 0.2 miles in length to demonstrate that compaction to between 92.0% and 97.0% in-place density can be obtained. Continue this procedure until a test section with the correct density can be produced. The Engineer will allow only 2 test sections per day. When a test section producing satisfactory in-place air void content is placed, resume full production.

8) Shoulders and Ramps. Shoulders and ramps are subject to in-place density testing, unless otherwise shown on the plans.

9) Miscellaneous Areas. Miscellaneous areas include areas that are not generally subject to primary traffic, such as driveways, mailbox turnouts, crossovers, gores, spot level-up areas, and other similar areas. Miscellaneous areas also include level-ups and thin overlays if the layer thickness designated on the plans is less than the compacted lift thickness shown in Table 8.

Miscellaneous areas will not be included in the in place density testing. Compact areas that are not subject to in-place air void determination in accordance with ordinary compaction control.

b. Segregation (Density Profile). If shown on the plans, test for segregation using density profiles in accordance with Tex-207-F, Part V. Provide the Engineer with the results of the density profiles as they are completed. Areas defined as "Miscellaneous Areas," are not subject to density profile testing.

1) If density profiles are required by the plans, perform a density profile every time the screed stops, on areas that are identified by either the Contractor or the Engineer as having thermal segregation, and on any visibly segregated areas. If the screed does not stop, and there are no visibly segregated areas or areas that are identified as having thermal segregation, perform a minimum of 1 profile per 500 tons of compacted material or as directed by the Engineer.

2) Reduce the test frequency to a minimum of 1 profile per 2,000 tons of compacted material, or as directed by the Engineer, if 4 consecutive profiles are within established tolerances. Continue testing at this frequency unless a profile fails, at which point resume testing at a minimum frequency of 1 per 500 tons or as directed by the Engineer. The Engineer may further reduce the testing frequency based on a consistent pattern of satisfactory results.

3) Unless otherwise shown on the plans, the density profile is considered failing if it exceeds the tolerances in Table 11. No production or placement bonus will be paid for any sublot that contains a failing density profile. The Engineer may make as many independent density profile verifications as deemed necessary. The Engineer's density profile results will be used when available.

4) Investigate density profile failures and take corrective actions during production and placement to eliminate the segregation. Suspend production if 2 consecutive density profiles fail, unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

Table 11 Segregation (Density Profile) Acceptance Criteria

Mixture Type	Maximum Allowable Density Range (Highest to Lowest)	Maximum Allowable Density Range (Average to Lowest)
Type A & Type B	8.0 pcf	5.0 pcf
Type C, Type D, & Type F	6.0 pcf	3.0 pcf

c. Longitudinal Joint Density.

1) Informational Tests. While establishing the rolling pattern, perform joint density evaluations and verify that the joint density is no more than 3.0 pounds per cubic foot below the density taken at or near the center of the mat. Adjust the rolling pattern if needed to achieve the desired joint density. Perform additional joint density evaluations at least once per sublot unless otherwise directed.

2) Record Tests. If shown on the plans, for each 500 tons of compacted material or as directed by the Engineer, perform a joint density evaluation at each pavement edge that is or will become a longitudinal joint. Determine the joint density in accordance with Tex-207-F, Part VII. Record the joint density information and submit results to the Engineer. The evaluation is considered failing if the joint density is more than 3.0 pounds per cubic foot below the density taken at the core random sample location and the correlated joint density is less than 90.0%. The Engineer may make independent joint density verifications at the random sample locations. The Engineer's joint density test results will be used when available.

Investigate joint density failures and take corrective actions during production and placement to improve the joint density. Suspend production if 2 consecutive evaluations fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

d. Recovered Asphalt DSR. The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Engineer. The aging ratio is the dynamic shear rheometer (DSR) value of the extracted binder divided by the DSR value of the original unaged binder (including RAP binder). DSR values are obtained according to AASHTO T 315 at the specified high temperature performance grade of the asphalt. The binder from RAP will be included proportionally as part of the original unaged binder. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores using Tex-211-F.

e. Irregularities. Immediately take corrective action if surface irregularities, including but not limited to segregation, rutting, raveling, flushing, fat spots, mat slippage, color, texture, roller marks, tears, gouges, streaks, or uncoated aggregate particles, are detected.

1) The Engineer may allow placement to continue for at most 1 day of production while taking appropriate action. If the problem still exists after that day, suspend paving until the problem is corrected to the satisfaction of the Engineer.

2) At the expense of the Contractor and to the satisfaction of the Engineer, remove and replace any mixture that does not bond to the existing pavement or that has other surface irregularities identified above.

3. Individual Loads of Hot Mix. The Engineer can reject individual truckloads of hot mix. When a load of hot mix is rejected for reasons other than temperature, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances shown in Table 7, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load and the Engineer may require removal.

4. Ride Quality. When required by the plans, measure ride quality in accordance with TxDOT Standard Specification Item 585, "Ride

Quality for Pavement Surfaces." Surface Test Type A or B as well as Pay Schedule 1, 2, or 3 shall also be indicated on the plans.

END OF SECTION

SECTION 02742

PRIME COAT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prime coat for asphalt concrete paving

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment will be made for prime coat on the basis of gallons applied under this Section.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed prime coat.

C. Submit report of recent calibration of distributor.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Bituminous. Unless the type and grade are shown on the plans, utilize an MC-30 or AE-P asphalt cement in accordance with Item 300, “Asphalts, Oils, and Emulsions” of the Standard Specifications of the Texas Department of Transportation for prime coat. Where Emulsified Asphalts are used, the amount of emulsified asphalt as a percentage by volume of the total mixture shall be within the limits shown on the plans, or shall be of a percentage as directed by the Engineer.

Blotter. Unless otherwise shown on the plans or approved, use either base course sweepings obtained from cleaning the base or sand as blotter materials.

2.02 EQUIPMENT

Provide applicable equipment in accordance with this specification or as specified on the plans.

A. Distributor. Furnish a distributor that will apply the asphalt material uniformly at the specified rate or as directed.

1. Transverse Variance Rate. When a transverse variance rate is shown on the plans, confirm that the nozzles outside the wheel paths will output a predetermined percentage more of asphalt material by volume than the nozzles over the wheel paths.

2. Calibration.

a. Transverse Distribution. Furnish a distributor test report, no more than 1 year old, documenting that the variation in output for individual nozzles of the same size does not exceed 10% when tested at the greatest shot width in accordance with Tex-922-K, “Calibrating Asphalt Distribution Equipment,” Part III. Include the following documentation on the test report:

• the serial number of the distributor,

• a method that identifies the actual nozzle set used in the test, and

• the fan width of the nozzle set at a 12 inch bar height.

b. When a transverse variance rate is required, perform the test using the type and grade of asphalt material to be used on the project. The Engineer may verify the transverse rate and distribution at any time. If verification does not meet the requirements, correct deficiencies and furnish a new test report.

B. Tank Volume. Furnish a volumetric calibration and strap stick for the distributor tank in accordance with Tex-922-K, “Calibrating Asphalt Distribution Equipment,” Part I.

Calibrate the distributor within the previous 3 years of the date first used on the project. The Engineer may verify calibration accuracy in accordance with Tex-922-K, “Calibrating Asphalt Distribution Equipment,” Part II.

C. Computerized Distributor. When paying for asphalt material by weight, the Engineer may allow use of the computerized distributor display to verify application rates. Verify application rate accuracy at a frequency acceptable to the Engineer.

D. Broom. Furnish rotary, self-propelled brooms.

E. Rollers. Rollers provided shall meet the requirements for their type as shown in TxDOT Item 210, “Rollers.”

F. Asphalt Storage and Handling Equipment. When the plans or the Engineer allows storage tanks, furnish a thermometer in each tank to indicate the asphalt temperature continuously. Keep equipment clean and free of leaks. Keep asphalt material free of contamination.

G. Digital Measuring Instrument. Furnish a vehicle with a calibrated digital-measuring instrument accurate to ±6 ft. per mile.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. General. Apply the mixture when the air temperature is 60ºF and above, or above 50ºF and rising. Measure the air temperature in the shade away from artificial heat. The Engineer will determine when weather conditions are suitable for application. Do not permit traffic, hauling, or placement of subsequent courses over freshly constructed prime coats. Maintain the primed surface until placement of subsequent courses or acceptance of the work

B. Surface Preparation. Prepare the surface by sweeping or other approved methods. When directed, before applying bituminous material, lightly sprinkle the surface with water to control dust and ensure absorption.

C. Application.

1. Bituminous. The Engineer will select the application temperature within the limits recommended in TxDOT Item 300, “Asphalts, Oils, and Emulsions.” Apply material within 15ºF of the selected temperature.

   Unless otherwise shown on the plans, prime coat shall be applied at a rate not to exceed 0.20 gallon per square yard of surface. The prime coat shall be applied evenly and smoothly, under a pressure necessary for proper distribution. When emulsified asphalts are used as prime coat, agitate the water and emulsified asphalt to produce a uniform blend. Evenly distribute, at the rate specified, to location shown on the plans or as directed. Regulate the percentage of emulsified asphalt in the mixture and distribute successive applications to achieve the specified rate, if necessary.

   During the application of prime coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutters or structures. When directed, roll the freshly applied prime coat with a pneumatic-tire roller to ensure penetration.

2. Blotter. Spread blotter material before allowing traffic to use a primed surface. When “Prime Coat and Blotter” is shown on the plans as a bid item, apply blotter material to primed surface at the rate shown in the plans or as directed. When “Prime Coat” is shown on the plans as a bid item, apply blotter to spot locations or as directed to accommodate traffic movement through the work area. Remove blotter material before placing the surface. Dispose of blotter material according to applicable state and federal requirements.

END OF SECTION

SECTION 02743

TACK COAT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tack coat for asphalt concrete paving.

1.02 MEASUREMENT AND PAYMENT

A Unit Prices.

1. Payment will be made for tack coat on the basis of gallons applied under this Section.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 244 - Standard Test Methods for Emulsified Asphalts.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed tack coat.

C. Submit report of recent calibration of distributor.

PART 2 PRODUCTS

2.01 EMULSION

A. The asphaltic material used for Tack Coat shall meet the requirements for “Asphalt Cement”, “Cut-Back Asphalt” or “Emulsified Asphalt” in Item No. 300, “Asphalts, Oils and Emulsions” of the Texas Department of Transportation Standard Specifications..

B. The asphaltic material used for Tack Coat shall be the type or grade shown in the referring specification, or on the plans, or as directed/approved by the

Engineer. Unless otherwise shown on the plans or approved, furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course or concrete surface of loose material by brooming prior to tack coat application.

3.03 APPLICATION

A. Apply tack coat uniformly by use of approved distributor at rate not to exceed 0.10 gallons per square yard of surface depending on texture of underlying surface. Select an application rate that will provide appropriate asphalt residual.

B. Paint contact surfaces of curbs, structures, and joints with thin uniform coat of tack coat.

3.04 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied tack coat until authorized by Project Manager.

END OF SECTION

SECTION 02751

CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete paving is on square yard basis. Separate pay items are used for each different required thickness of pavement.

2. Payment for concrete paving, high early strength, is on square yard basis.

3. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

5. Refer to Paragraph 3.15, Unit Price Adjustment.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 185 - Standard Specifications for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

D. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

E. ASTM C 33 - Standard Specifications for Concrete Aggregates.

F. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

G. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

H. ASTM C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

I. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading).

J. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

K. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

L. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

M. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

N. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

O. ASTM C 150 - Standard Specification for Portland Cement.

P. ASTM C 174 - Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.

Q. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

R. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

S. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

T. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

U. TxDOT Tex-203-F - Sand Equivalent Test.

V. TxDOT Tex-406-A - Material Finer than 75 Fm (No. 200) Sieve In Mineral Aggregates (Decantation Test for Cement Aggregates).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed mix design and test data for each type and strength of concrete in work. Include proportions and actual flexural strength obtained from design mixes at required test ages.

C. Submit for approval manufacturer's description and characteristics for mixing equipment, and for traveling form paver, when proposed for use.

D. Submit manufacturer's certificates giving properties of reinforcing steel. Include certificate of compliance with ASTM A 82. Provide specimens for testing when required by Public Works.

1.05 HANDLING AND STORAGE

A. Do not mix different classes of aggregate without written permission of Public Works.

B. Class of aggregate being used may be changed before or during work with written permission of Public Works. Comply new class with specifications.

C. Reject segregated aggregate. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.

D. Reject aggregates mixed with dirt, weeds, or foreign matter.

E. Do not dump or store aggregate in roadbed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement:

1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.

2. Bulk cement which meets referenced standards may be used when

method of handling is approved by Public Works. When using bulk cement, provide satisfactory weighing devices.

3. Fly ash which meets standards of ASTM C 618 may be used as mineral fill when method of handling is approved by Public Works.

B. Water: Conform to requirements for water in ASTM C 94.

C. Coarse Aggregate: Crushed stone, gravel, or combination thereof, which is clean, hard, and durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131).

1. Maximum percentage by weight of deleterious substances shall not exceed following values:

ITEM	PERCENT BY WEIGHT OF TOTAL SAMPLE MAXIMUM
Clay lumps and friable particles	3.0
Material finer than 75-µm (No. 200) sieve:	
Concrete subject to abrasion	3.0*
All Other concrete	5.0*
Coal and lignite	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

* In case of manufactured sand, when material finer than 75-µm (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Conform coarse aggregate (size 1 ½-In. to No. 4 sieve) to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 1 ¾" sieve	0
Retained on 1 ½" sieve	0 to 5
Retained on ¾" sieve	30 to 65
Retained on 3/8" sieve	70 to 90
Retained on No. 4 sieve	95 to 100
Loss by Decantation Test *Method Tex-406-A	1.0 maximum

* In case of aggregates made primarily from crushing of stone, when material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of TxDOT Tex-406-A, percent may be increased to 1.5.

D. Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Conform fine aggregate for concrete to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 3/8" sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90
Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.

E. Mineral Filler: Type "C" or Type "F" fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture.

When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementatious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.

F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.

G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by Public Works.

H. Reinforcing Steel:

1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.

2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be re-bent.

3. Provide wire fabric conforming to ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.

2.02 EQUIPMENT

A. Conform Equipment to requirements of ASTM C 94.

2.03 MIXING

A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for work. Mix shall conform to these specifications and other requirements indicated on Drawings.

B. Mix design to produce concrete which will have flexural strength of 500 psi at 7 days and 600 psi at 28 days. Slump of concrete shall be at least 2-In. but no more than 5-In., when tested in accordance with ASTM C 143.

1. Concrete pavement, including curb, curb and gutter, and saw-tooth curb, shall contain at least 5 1/2 sacks (94 pounds per sack) of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement (water-cement ratio maximum 0.57). Determine cement content in accordance with ASTM C 138. Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.

2. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.

3. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C

231.

4. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

C. Use high early strength concrete pavement to limits shown on Drawings. Design to meet following:

1. Concrete Mix: Flexural strength greater than or equal to 500 psi at 72 hours.

2. Cement: Minimum of 7 sacks of cement per cubic yard of concrete.

3. Water-Cement Ratio maximum of 0.45. Slump of concrete shall a maximum of 5-In., when tested in accordance with ASTM C 143.

4. Other requirements for proportioning, mixing, execution, testing, etc., shall be in accordance with this Section 02751 - Concrete Paving.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted base is ready to support imposed loads and meets compaction requirements.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Properly prepare, shape and compact each section of subgrade before placing forms, reinforcing steel or concrete. After forms have been set to proper grade and alignment, use subgrade planer to shape subgrade to its final cross section. Check contour of subgrade with template.

B. Remove subgrade that will not support loaded form. Replace and compact subgrade to required density.

3.03 EQUIPMENT

A. Alternate equipment and methods, other than those required by this Section, may be used provided equal or better results will be obtained. Maintain equipment for preparing subgrade and for finishing and compacting concrete in good working order.

B. Subgrade Planer and Template:

1. Use subgrade planer with adjustable cutting blades to trim subgrade to exact section shown on Drawings. Select planer mounted on visible rollers which ride on forms. Planer frame must have sufficient weight so that it will remain on form, and have strength and rigidity that, under tests made by changing support from wheels to center, planer will not develop deflection of more than 1/8-In. Tractors used to pull planer shall not produce ruts or indentations in subgrade. When slip form method of paving is used, operate subgrade planer on prepared track grade or have it controlled by electronic sensor system operated from string line to establish horizontal alignment and elevation of subbase.

2. Provide template for checking contour of subgrade. Template shall be long enough to rest upon side forms and have strength and rigidity that, when supported at center, maximum deflection shall not exceed 1/8-In. Fit template with accurately adjustable rods projecting downward at 1-Ft.t intervals. Adjust these rods to gauge cross sections of slab bottom when template is resting on side forms.

C. Machine Finisher: Provide power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires when it operates on concrete pavement.

D. Hand Finishing:

1. Provide mechanical strike and tamping template 2-Ft. longer than width of pavement to be finished. Shape template to pavement section.

2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.

E. Burlap Drag or transverse broom for Finishing Slab: Furnish four plies of 10 ounce burlap material fastened to bridge to form continuous strip of burlap full width of pavement. Maintain contact 3-Ft. width of burlap material with pavement surface. Keep burlap drags clean and free of encrusted mortar.

F. Vibrators: Furnish mechanically-operated, synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated

mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.

G. Traveling Form Paver: Approved traveling form paver may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. Meet requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship. When traveling form paver does not provide concrete paving that meets compaction, finish, and tolerance requirements of this Specification, immediately discontinue its use and use conventional methods.

1. Equip traveling paver with longitudinal transangular finishing float adjustable to crown and grade. Use float long enough to extend across pavement to side forms or edge of slab.

2. Ensure that continuous deposit of concrete can be made at paver to minimize starting and stopping. Use conventional means of paving locations inaccessible to traveling paver, or having horizontal or vertical curvature that traveling paver cannot negotiate.

3. Where Drawings require tie bars for adjacent paving, securely tie and support bars to prevent displacement. Tie bars may be installed with approved mechanical bar inserter mounted on traveling-form paver. Replace pavement in which tie bars assume final position other than that shown on Drawings.

3.04 FORMS

A. Side Forms: Use metal forms of approved shape and section. Preferred depth of form is equal to required edge thickness of pavement. Forms with depths greater or less than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness when not greater than 1-In., and further provided that forms of depth less than pavement edge are brought to required edge thickness by securely attaching wood or metal strips to bottom of form, or by grouting under form. Bottom flange of form shall be same size as thickness of pavement. Aluminum forms are not allowed. Forms shall be approved by Public Works. Length of form sections shall be not less than 10-Ft. and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200-Ft. radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. In no case shall base width be less than 8-In. for form 8-In. or more in height. Forms shall be free from warp,

bends or kinks and shall be sufficiently true to provide straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10-Ft. in length or curved forms may be used. For curb returns at street intersections and driveways, wood forms of good grade and quality may be used.

B. Form Setting:

1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8-In. in 10-Ft. of length. Do not remove forms for at least 8 hours after completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300-Ft. ahead of mixer or as approved by Public Works.

2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. Do not use adjacent slabs for forms until concrete has aged at least 7 days.

3.05 REINFORCING STEEL AND JOINT ASSEMBLIES

A. Place reinforcing steel and joint assemblies and position securely as indicated on Drawings. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Secure reinforcing steel to chairs.

B. Position pavement joint assemblies at required locations and elevations, and rigidly secure in position. Install dowel bars in joint assemblies, each parallel to pavement surface and to center line of pavement, as shown.

C. Cut header boards, joint filler, and other material used for forming joints to receive each dowel bar.

D. Secure in required position to prevent displacement during placing and finishing of concrete.

E. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required to provide rigid pavement sections.

F. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as

shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than ¼-In.

3.06 FIBROUS REINFORCING

A. Do not use fibrous reinforcing to replace structural, load-bearing, or moment-reinforcing steel.

3.07 PLACEMENT

A. Place concrete when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Do not place concrete when temperature is below 40 degrees F and falling.

B. Place concrete within 90 minutes after initial water had been added. Remove and dispose of concrete not placed within this period.

C. Concrete slump during placement shall be 1 to 5-In., except when using traveling-form paver, slump shall be maximum of 2-In.

D. Deposit concrete continuously in successive batches. Distribute concrete in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At placement interruption of more than 30 minutes, place transverse construction joint at stopping point. Remove and replace sections less than 10-Ft. long.

E. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.

3.08 COMPACTION

A. Consolidate concrete using mechanical vibrators as specified herein. Extend vibratory unit across pavement, not quite touching side forms. Space individual vibrators at close enough intervals to vibrate and consolidate entire width of pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.

B. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.09 FINISHING

A. Finish concrete pavement with power-driven transverse finishing machines or by hand finishing methods.

1. Hand finish with mechanical strike and tamping template in same width as pavement to be finished. Shape template to pavement section shown on Drawings. Move strike template forward in direction of placement, maintaining slight excess of material in front of cutting edge. Make minimum of two trips over each area. Screened pavement surface to required section. Work screened with combined transverse and longitudinal motion in direction work is progressing. Maintain screed in contact with forms. Use longitudinal float to level surface.

B. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with strike-off screed. Move strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Tamp concrete with tamping template. Use longitudinal float to level surface.

C. After completion of straightedge operation, make first pass of burlap drag or transverse broom as soon as construction operations permit and before water sheen has disappeared from surface. Follow with as many passes as required to produce desired texture depth. Permit no unnecessary delays between passes. Keep drag wet, clean and free from encrusted mortar during use.

3.10 JOINTS AND JOINT SEALING

A. Conform to requirements of Section 02752 - Concrete Pavement Joints.

3.11 CONCRETE CURING

A. Conform to requirements of Section 02753 - Concrete Pavement Curing.

3.12 TOLERANCES

A. Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish. Place 10-Ft. straightedge parallel to center of roadway to bridge depressions and touch high spots. Do not permit ordinates measured from face of straight edge to surface of pavement to exceed 1/16-In./Ft. from nearest point of contact. Maximum ordinate with 10-Ft. straightedge shall

not exceed 1/8-In. Grind spots in excess of required tolerances to meet surface test requirements. Restore texture by grooving concrete to meet surface finishing specifications.

3.13 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Compressive Strength Test Specimens: Make four test specimens for compressive strength test in accordance with ASTM C 31 for each 150 cubic yards or less of pavement that is placed in one day. Test two specimens at 7 days or at number of hours as directed by the Public Works for high early strength concrete. Test remaining two specimens at 28 days. Test specimens in accordance with ASTM C 39. Minimum compressive strength shall be 3000 pounds per square inch for first two specimens and 3500 pounds per square inch at 28 days.

C. When compressive test indicates failure, make yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. Minimum of one 4-In. core will be taken at random locations per 375-Ft. per 12-Ft. lane or 500 square yards of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3000 pounds per square inch.

E. Request, at option, three additional cores in vicinity of cores indicating nonconforming in- place depths at no cost to the City. In-place depth at these locations shall be average depth of four cores.

F. Fill cores and density test sections with new concrete paving or non shrink grout.

3.14 NONCONFORMING PAVEMENT

A. Remove and replace areas of pavement found deficient in thickness by more than 10 percent, or that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. When measurement of any core is less than specified thickness by more than 10 percent, actual thickness of pavement in this area will be

determined by taking additional cores at 10-Ft intervals parallel to centerline in each direction from deficient core until, in each direction, core is taken which is not deficient by more than 10 percent. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine length of pavement in unit that is to be removed and replaced. Replace nonconforming pavement sections at no additional cost to City.

3.15 UNIT PRICE ADJUSTMENT

A. Unit price adjustments shall be made for in-place depth determined by cores as follows:

1. Adjusted Unit Price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price.

2. Apply adjustment to lower limit of 90 percent and upper limit of 100 percent of unit price.

3. Average depth below 90 percent but greater than 80 percent may be accepted by Public Works at adjusted Unit Price of:

   a. Unit Price Bid - [2 x (1-ratio) x Unit Price Bid]

   b. Ratio equals average core thickness divided by thickness bid upon

   c. 0.9 ratio pays 80 percent of unit price and 0.8 ratio pays 60 percent of unit price.

4. Average depth below 80 percent will be rejected by Public Works.

3.16 PAVEMENT MARKINGS

A. Restore pavement markings to match those existing in accordance with City of Schertz standard specifications and details and Public Works' requirements.

3.17 PROTECTION

A. Barricade pavement section to prevent use until concrete has attained minimum design strength. Cure barricade pavement section for minimum 72 hours before use. Do not open pavement to traffic until concrete is at least 10 days old. Pavement may be open to traffic earlier provided Contractor pays for testing and additional specimen once 7 day specified strength is obtained. Pavement may be opened when high early strength

concrete is used meeting specified 72 hour strength.

B. High early strength concrete may be used to provide access at driveways, street intersections, esplanades and other locations approved by Public Works.

C. On those sections of pavement to be opened to traffic, seal joints, clean pavement, and place earth against pavement edges before permitting use by traffic. Opening of pavement to traffic shall not relieve responsibility for work.

D. Maintain concrete paving in good condition until completion of work.

E. Repair defects by replacing concrete to full depth.

END OF SECTION

SECTION 02752

CONCRETE PAVEMENT JOINTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment for street pavement expansion joints, with or without load transfer. Include in price for concrete pavement.

2. No separate payment for horizontal dowels. Include in price for concrete pavement

3. No separate payment will be made for formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include payment in unit price for Concrete Paving.

4. No separate payment will be made for joints for Curb, Curb and Gutter, Saw-tooth Curb, Concrete Sidewalks, and Concrete Driveways. Include payment in unit price for Curb and Gutter, Concrete Sidewalks, and Concrete Driveways.

5. Payment will be made for Preformed Expansion Joints on a linear foot basis only when field conditions require that sidewalk be moved adjacent to existing concrete structure (i.e., street, back of curb, etc.).

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel

Bars for Concrete Reinforcement.

B. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

C. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. ASTM D 3405 - Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

E. TxDOT Tex-525-C - Tests for Asphalt and Concrete Joint Sealers

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for joint sealing compound and proposed sealing equipment for approval.

C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval. Submit manufacturer's recommendation for placing sealant(s).

PART 2 PRODUCTS

2.01 BOARD EXPANSION JOINT MATERIAL

A. Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.

2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.02 PREFORMED EXPANSION JOINT MATERIAL

A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.03 JOINT SEALING COMPOUND

A. Conform joint sealants to one of sealant classes described in this section.

B. Conform hot-poured rubber-asphalt compound to ASTM D 3405.

C. Two-component Synthetic Polymer.

1. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.

2. Cure sufficiently at average temperature of 25 ** 1 C (77 ** 2 F) so as not to pick up under wheels of traffic in maximum three hours.

3. Performance requirements, when tested in accordance with TxDOT Tex-525-C, shall meet above curing times and requirements as follows:

Table 1 Cold-Extruded and Cold-Pourable (Self Leveling) Specifications

Property	**Requirement**
Penetration, 25C (77 F) 150g Cone, 5 S, 0.1 mm (in.), Maximum	130
Bond and Extension 50%, -29 C (-20 F), 3 cycles: C Dry Concrete Block C Steel Blocks (Primed, if recommended by manufacturer) *Steel blocks shall be used when armor joints are specified	 Pass Pass
Flow at 70 C (158 F)	None
Water content % by mass, maximum	5.0
Resilience: C Original sample, % min. (cured) C Oven-aged at 70 C (158 F), % min.	 50 50
Cold-Extruded material only – Cold Flow (10 minutes)	None

After bond and extension test, there shall be no evidence of cracking, separation or other opening that is over 3 millimeters (1/8-In.) deep in sealer or between sealer and test blocks.

4. Provide cold-extruded type for vertical or sloping joints.

5. Provide self-leveling type for horizontal joints.

D. Self-Leveling, Low Modulus Silicone or Polyurethane Sealant for Asphaltic Concrete and Portland Cement Concrete Joints. This shall be a single component self-leveling silicone or polyurethane material that is compatible with both asphalt and concrete pavements. The sealer shall not require a primer for bond; a backer rod shall be required which is compatible with the sealant; no reaction shall occur between rod and sealant.

When tested in accordance with TxDOT Tex-525-C, self-leveling sealant shall meet following requirements:

Table 2 Self-Leveling, Low Modulus Silicone or Polyurethane Sealant

Property	**Requirements**

Tack Free Time, 25” 1 C (77” 2 F), minutes	120 maximum
Nonvolatile content, % by mass	93 minimum
Tensile Strength and 24 Hour Extension Test: C Initial, 10-day cure, 25 “ 1C (77”2F), kPa (psi) C After Water Immersion, Kpa (psi) C After Heat Aging, kPa (psi) C After Cycling, -29 C (-20 F), 50%, 3 cycles, kPa (psi) C 24 Hour Extension	 C 21 to 69 (3 to 10) C 21 to 69 (3 to 10) C 21 to 69 (3 to 10) C 21 to 69 (3 to 10) C Pass (All Specimens) After 24 hours, there shall b no evidence of cracking, separation or other opening that is over 3 mm (1/8 in.) deep at any point in the sealer or between the sealer and test blocks.

2.04 LOAD TRANSMISSION DEVICES

A. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16-In. greater than diameter of dowel bar.

B. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

2.05 SUPPORTS FOR REINFORCING STEEL AND JOINT ASSEMBLY

A. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by Public Works.

PART 3 EXECUTION

3.01 PLACEMENT

A. When new work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2-In. deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.02 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30-In. long and spaced 18-In. on centers.

3.03 EXPANSION JOINTS

A. Place ¾-In. expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80-Ft. apart. Use no boards shorter than 6-Ft. When pavement is 24-Ft. or narrower, use not more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Drawings unless otherwise specified or shown as "No Load Transfer Device." Seal with joint sealing compound.

3.04 CONTRACTION JOINTS

A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

3.05 LONGITUDINAL WEAKENED PLANE JOINTS

A. Place longitudinal weakened plane joints at spaces indicated on Drawings. If more than 15-Ft. in width is poured, longitudinal joint must be saw cut. Seal groove with joint sealing compound.

3.06 SAWED JOINTS

A. Use sawed joints as alternate to contraction and weakened plane joints. Use circular cutter capable of cutting straight line groove minimum of ¼-In. wide. Maintain depth of one quarter of pavement thickness. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, continue until completed. Make saw cut with one pass. Complete sawing within 24 hours of concrete placement. Saw joints at required spacing consecutively in sequence of concrete placement.

B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Maintain ample supply of saw blades at work site during sawing operations. Maintain sawing equipment on job during concrete placement.

3.07 JOINTS FOR CURB, CURB AND GUTTER

A. Place ¾-In. preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement, at end of radius returns at street intersections and driveways, and at curb inlets. Maximum spacing shall be 120-Ft. centers.

3.08 JOINTS FOR CONCRETE SIDEWALKS

A. Provide ¾-In. expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 36-Ft. Provide expansion joint material conforming to ASTM D 994 for small radius curves and around fire hydrants and utility poles. Extend expansion joint material full depth of slab.

3.09 JOINTS FOR CONCRETE DRIVEWAYS

A. Provide 3/4-In. expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

3.10 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.

B. Use joint sealing equipment in like new working condition throughout joint sealing operation, and be approved by Public Works. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.

C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be ¼-In. above level of adjacent surface or at elevation as directed.

3.11 PROTECTION

A. Maintain joints in good condition until completion of work.

B. Replace damaged joints material with new material as required by this Section.

END OF SECTION

SECTION 02753

CONCRETE PAVEMENT CURING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for concrete curing under this Section. Include payment in unit price for Concrete Paving, Concrete Sidewalks, Concrete Driveways, Curbs, and Curb and Gutters.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 156 - Standard Test Method for Water Retention by Concrete Curing Materials.

B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.

C. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 PRODUCTS

2.01 COVER MATERIALS FOR CURING

A. Conform curing materials to one of the following:

1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.

2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.

3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Stitch mats so that mat will contact surface of pavement at all points when saturated with water.

2.02 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Conform liquid membrane-forming compounds to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m^2 in 72 hours using test method ASTM C 156.

PART 3 EXECUTION

3.01 CURING REQUIREMENT

A. Cure concrete pavement by protecting against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphalt concrete.

B. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.02 POLYETHYLENE FILM CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with polyethylene film so film will remain in direct contact with surface during specified curing period.

B. Cover entire surface and both edges of pavement slab. Overlap joints in film sheets minimum of 12-In. Immediately repair tears or holes occurring

during curing period by placing acceptable moisture-proof patches or replacing.

3.03 WATERPROOFED PAPER CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in direct contact with surface during specified curing period.

B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60-Ft. in length. Overlap joints in blankets caused by joining paper sheets not less than 5-In. and securely seal with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure overlap of at least 12-In. Immediately repair tears or holes appearing in paper during curing period by cementing patches over defects.

3.04 COTTON MAT CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, maintaining contact with surface of pavement equally at all points.

B. Keep mats on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.05 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Immediately after free surface moisture, and after concrete has dispersed, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

B. Moisten concrete by water fogging prior to application of membrane when surface has become dry.

C. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by Public Works, but not less than one gallon per 200 square feet of surface area.

3.06 TESTING MEMBRANE

A. Treated areas will be visually inspected for areas of lighter color of dry concrete as compared to dump concrete. Test suspected areas by placing

few drops of water on surface. Membrane passes test when water stands in rounded beads or small pools which can be blown along surface of concrete without wetting surface.

B. Reapply membrane compound immediately at no cost to City when membrane fails above test.

END OF SECTION

SECTION 02754

CONCRETE DRIVEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement concrete driveways.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete driveways is on square yard basis, including excavation.

2. No payment will be made for work in areas where driveway has been removed or replaced for Contractor's convenience.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for reinforcing steel of Section 02751 - Concrete Paving.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Subgrade Materials: Conform to subgrade material requirements of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade, or Section 02338 - Portland Cement Stabilized

Subgrade.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare subgrade in accordance with applicable portions of Section 02330 - Embankment.

3.02 PLACEMENT

A. Place and finish concrete in accordance with applicable portions of Section 02751 – Concrete Paving.

3.03 JOINTS

A. Install joints in concrete driveway in accordance with Section 02752 - Concrete Pavement Joints.

3.04 CONCRETE CURING

A. Cure concrete driveway in accordance with Section 02753 - Concrete Pavement Curing.

3.05 PROTECTION

A. Conform to applicable requirements of Section 02753 - Concrete Pavement Curing.

END OF SECTION

SECTION 02761

COLORED CONCRETE FOR MEDIANS AND SIDEWALKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Colored concrete for medians and sidewalks.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for coloring agent under this Section. Include payment in unit price bid for concrete sidewalks, and concrete medians and directional islands.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed coloring agent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Coloring Agent: Provide dry-shake color hardener consisting of quartz-silica mixture of finely-graded, non-metallic aggregates, plasticizer and cement binder for producing color as shown on Drawings.

B. Concrete: Conform to material and proportion requirements of Section 02751 – Concrete Paving.

PART 3 EXECUTION

3.01 CONCRETE MEDIANS

A. Install concrete medians in accordance with requirements of Part 3 of

Section 02772 - Concrete Medians and Directional Islands with addition of procedure for application of coloring agent as required by Paragraph 3.03, Coloring Agent.

3.02 CONCRETE SIDEWALKS

A. Install concrete sidewalks in accordance with requirements of Part 3 of Section 02775 - Concrete Sidewalks with addition of procedure for application of coloring agent as required by Paragraph 3.03, Coloring Agent.

3.03 COLORING AGENT

A. Apply coloring agent on newly finished concrete surface as soon as job conditions permit, but in no event later than 2 hours after concrete is placed, at rate recommended by manufacturer and approved by Public Works.

B. Apply color hardener uniformly to surface by dry-shake method when no excess moisture shows at surface of concrete substrate, but while concrete is still plastic throughout. Do not sprinkle or otherwise add water to surface during application or finishing. Necessary moisture for color hardener shall come from concrete substrate in order to develop proper bond and assure adequate density for color-hardened surface.

C. First shake shall consume two-thirds of material. Withhold one-third for second shake and final touch-up. After first shake, float surface thoroughly by mechanical or hand methods. Do not trowel surface between first and second shakes.

D. Apply second shake evenly, then float and trowel surface. Retain small quantity of material from second shake for touching up nonuniform or weak-toned areas. Minimize hard troweling and use consistent finishing practices to ensure uniformity of color.

END OF SECTION

SECTION 02762

BLAST CLEANING OF PAVEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of existing pavement markings.

B. Preparation of pavement surfaces for new pavement markings.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for blast cleaning of roadway lanes is on linear foot basis for each width, measured in place.

2. Payment for blast cleaning of symbols and legends is on square foot basis, measured in place.

3. Payment for removal of raised pavement markings, all types, is on a lump sum basis.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit description and characteristics of proposed blasting medium and equipment for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Blasting Media: Quality commercial product capable of producing specified surface cleanliness without deposition of deleterious materials on cleaned pavement surface. Do not use high silica content sand that may result in high levels of free crystalline silica dust particles as blasting

agent.

2.02 EQUIPMENT

A. Equipment shall be power driven and of sufficient capacity to remove pavement markings. Equipment shall utilize moisture and oil traps of sufficient capacity to remove contaminants from air and prevent deposition of moisture, oil, or other contaminants on pavement surface.

PART 3 EXECUTION

3.01 REMOVAL OF EXISTING MARKINGS

A. Remove pavement markings where necessary to prevent driver confusion, or where indicated on Drawings. Included are areas where it will be necessary for drivers to cross existing markings which they would not normally cross. Remove or obliterate markings. Do not damage pavement surface.

3.02 CLEANING FOR PLACEMENT OF MARKERS

A. Remove old pavement markings, loose material, and other contaminants deleterious to adhesion of new pavement markings to be placed. On Portland cement concrete pavement, minimize over blasting to prevent damage to pavement surface. Small particles of tightly adhering existing pavement markings may remain when complete removal will result in pavement surface damage.

B. Follow manufacturer's written instructions for proper cleaning of pavement surfaces to receive pavement marking.

END OF SECTION

SECTION 02764

RAISED PAVEMENT MARKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Raised reflective pavement markers and jiggle bars.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for Type I raised reflective pavement markers with one reflective face is for each marker installed.

2. Payment for Type I raised reflective pavement markers with two reflective faces is for each marker installed.

3. Payment for Type I raised pavement markers with no reflective face is for each marker installed.

4. Payment for Type II raised reflective pavement markers with one reflective face is for each marker installed.

5. Payment for Type II raised reflective pavement markers with two reflective faces is for each marker installed.

6. Payment for Type "W" jiggle bars is on a unit price basis for each jiggle bar.

7. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 2444 - Standard Test Method for Determination of Impact Resistance of Thermoplastic Pipe and Fittings by means of a Tup (Falling Weight).

B. ASTM E 808 - Standard Practice for Describing Retroreflection.

C. ASTM E 809 - Standard Practice for Measuring Photometric Characteristics of Retroreflectors.

D. Federal Specification L-P-380C - Plastic Molding Material Methacrylate.

E. TxDOT DMS-4100 - Jiggle BarTile.

F TxDOT DMS-4200, “Pavement Markers (Reflectorized).”

G TxDOT DMS-4300, “Traffic Buttons”

H. TxDOT DMS-6130 - Bituminous Adhesive for Pavement Markers.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data concerning following materials for approval:

1. Pavement Markers.

2. Primers, solvents, and adhesives.

3. Installation instructions.

C. Submit certificate by manufacturer that each marker and adhesive conforms to requirements of this Section.

D. Submit details of manufacturer's replacement policy for each type and class of marker.

PART 2 PRODUCTS

2.01 MARKERS

A. Furnish raised pavement markers meeting the requirements of the following TxDOT Material Specifications:

1. TxDOT DMS-4100 - Jiggle BarTile I-A, II-A-A, W, and Y;
2. TxDOT DMS-4200, “Pavement Markers (Reflectorized).” types I-A, I-C, I-R, II-A-A, and II-C-R;
3. TxDOT DMS-4300, “Traffic Buttons”, types I-A, I-C, I-R, II-A-A, II-C-R, W, and Y. Round or oval unless otherwise specified in the plans.

B. Type I-A must contain an approach face that retroreflects amber light. The

body, other than the retro-reflective face must be yellow.

C. Type I-C must contain an approach face that retroreflects white light. The body, other than the retro-reflective face must be white or silver-white.

D. Type I-R must contain a trailing face that retro-reflects red light. The body, other than the retro-reflective face must be white or silver-white.

E. Type II-A-A must contain two retro-reflective faces (approach and trailing) each that retro-reflect amber light. The body, other than the retro-reflective faces, must be yellow.

F. Type II-C-R must contain two retro-reflective faces, an approach face that retro-reflects white light and a trailing face that retro-reflects red light. The body, other than the retroreflective faces, must be white or silver-white.

G. Type W has a white body and no reflective faces.

H. Type Y has a yellow body and no reflective faces.

2.02 ADHESIVE

A. Adhesive:

1. Bituminous adhesive conforming to TxDOT DMS 6130 shall be used for jiggle bars, reflectorized pavement markers, and traffic buttons on bituminous pavements.

2. Epoxy adhesive conforming to TxDOT DMS 6100 and for jiggle bars, reflectorized pavement markers, and traffic buttons on on Portland cement concrete pavements.

3. Adhesives shall be as recommended by jiggle bar manufacturer for installation.

PART 3 EXECUTION

3.01 PREPARATION

A. Accurately locate and install approved markers to conform to classes and colors indicated on Drawings.

B. Clean and repair surfaces to receive markings. Remove loose material, dust, contaminants such as oil and curing membrane, and polished aggregates.

C. Blast clean surfaces indicated on Drawings or where directed by Public

Works in accordance with requirements of Section 02762- Blast Cleaning of Pavement. Do not clean Portland cement concrete pavements by grinding. Mechanical wire brushing may be used to remove curing membranes.

3.02 INSTALLATION

A. Prepare pavement surfaces and install markers in accordance with marker and adhesive manufacturer's recommendations.

B. Test pavement surface for moisture content prior to application of markings. Place approximate 2 square foot sheet of clear plastic or tar paper on road surface and hold in place for 20 minutes. Immediately inspect sheet for build up of condensed moisture. When sufficient moisture has condensed to cause water to drip from sheet, do not apply markings. Repeat test as necessary until adequate moisture has evaporated from pavement to allow placement.

C. Observe manufacturer's recommended pavement and ambient air temperature requirements for application. When manufacturer has no temperature recommendations, do not install markings when pavement temperature is below 60 degrees F or above 120 degrees F.

D. Position reflective face of markers so that direction of reflection of one (1) face is directly opposite to direction of reflection of other face.

E. Prepare surfaces to which markers are to be attached by adhesive by method to ensure that surface is free of dirt, curing compound, grease, oil, moisture, loose or unsound pavement markings and other materials which would adversely affect adhesive bond.

F. Establish guides to mark lateral location of pavement markings as shown on drawings. Guides placed on roadway for alignment purposes shall not establish permanent marking on roadway.

G. Place pavement markings in alignment with guides. Deviation rate in alignment shall not exceed 1-In. per 200-Ft. of roadway. Maximum deviation shall not exceed 2-In. nor shall deviation be abrupt. Remove and replace markings that are in alignment or sequence.

H. Apply adhesive in sufficient quantity to ensure adhesion and as recommended by manufacturer for installation.

I. Markers shall be free of rust, scale, dirt, oil, grease, moisture, or contaminants which might adversely affect adhesive bond.

J. Place markers immediately after adhesive is applied and firmly bond to pavement. Adhesive or other materials that impair functional reflectivity will not be acceptable.

K. Pavement markers shall not be in contact with pavement surface but shall be seated on continuous layer of adhesive. One hundred percent of bonding area of marker shall be in contact with adhesive.

L. For Bituminous adhesive use, pavement and pavement marker temperature shall be at least 40 degrees F. Do not heat Bituminous adhesive to temperature greater than 400 degrees F. Agitate Bituminous adhesive immediately to ensure even heat distribution.

M. Prime pavement surface and apply markings as recommended by manufacturer.

3.03 CLEANING

A. Keep project site free of unnecessary traffic hazards at all times.

B. Clean area upon completion of work and remove rubbish from work site.

3.04 WARRANTY

A. Warrant material and labor for period of 12 months from date of installation of markings.

END OF SECTION

SECTION 02765

TEMPORARY AND REMOVABLE REFLECTORIZED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary retroreflective preformed pavement markings for use in work zone areas.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Pavement will be by the foot or by each word, shape, symbol, or temporary flexible reflective roadway marker tab. Each stripe will be measured separately. Raised pavement markers used to simulate a marking will be measured by the foot of marking or by each raised pavement marker.

2. This price is full compensation for furnishing, placing, maintaining, and removing work zone pavement markings and for materials, equipment, labor, tools, and incidentals

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. TXDOT DMS-4200, “Pavement Markers (Reflectorized),”

B TXDOT DMS-4300, “Traffic Buttons,”

C TXDOT DMS-8240, “Permanent Prefabricated Pavement Markings,”

D TXDOT DMS-8241, “Removable Prefabricated Pavement Markings,”

E TXDOT DMS-8242, “Temporary Flexible-Reflective Road Marker Tabs,”

F TXDOT DMS-8200, “Traffic Paint,”

G TXDOT DMS-8220, “Hot Applied Thermoplastic,” and

H TXDOT DMS-8290, “Glass Traffic Beads.”

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for each proposed class of marking material and installation instructions for approval. Include certificate by manufacturer that each class of marking conforms to requirements of this Section.

C. Submit details of manufacturer's removal and replacement policy for each class of marker.

1.05 DELIVERY AND STORAGE

A. Deliver preformed plastic marking material in rolls or strips.

B. Store material in cool dry conditions as recommended by manufacturer until application.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide thermoplastic, paint and beads, raised pavement markers, prefabricated pavement markings, temporary flexible reflective roadway marker tabs, or other approved materials for work zone pavement markings.

B. Nonremovable Markings. Use hot-applied thermoplastic or permanent prefabricated pavement markings for nonremovable markings. Paint and beads or other materials are not allowed for nonremovable markings unless shown on the plans.

C. Removable and Short-Term Markings. Use raised pavement markers, removable prefabricated pavement markings, temporary flexible reflective roadway marker tabs, or other approved materials for removable and short-term markings. Do not use hot-applied thermoplastic or traffic paint for removable markings. Use removable prefabricated pavement markings on the final pavement surface when the plans specify removable markings.

2.02 PERFORMANCE REQUIREMENTS

A Performance Requirements. All markings must be visible from a

distance of at least 300 ft. in daylight conditions and from a distance of at least 160 ft. in nighttime conditions, illuminated by automobile lowbeam headlight. Determine visibility distances using an automobile traveling on the roadway under dry conditions.

B Maintain the markings for 30 calendar days after installation. The end of the 30-day maintenance period does not relieve the contractor from the performance deficiencies requiring corrective action identified during the 30-day period. If markings fail to meet the requirements of this section during the 30-day period, remove and replace them at the Contractor's expense. The 30-calendar day performance requirement will begin again after replacement of the markings.

C The daytime and nighttime reflected color of the markings must be distinctly white or yellow. The markings must exhibit uniform retroreflective characteristics.

PART 3 EXECUTION

3.01 INSTALLATION

A. Apply markings to clean dry surfaces in accordance with manufacturer's recommendations at locations indicated on Drawings, or as directed by City Engineer, per Section 02764 Raised Pavement Markers and Section 02767 Thermoplastic Pavement markings

B. Place markings on each paving lift that is to be opened to traffic prior to end of each day's work.

C. Maintain markings, and replace as needed, until they are covered with subsequent paving courses or replaced by permanent markings on final lifts.

3.02 REMOVAL

A. Remove and obliterate markings on existing and final lifts used for redirecting traffic during construction. When blast cleaning is required, comply with requirements of Section 02762 - Blast Cleaning of Pavement.

END OF SECTION

SECTION 02767

THERMOPLASTIC PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This item includes white thermoplastic pavement markings for crosswalks, stop lines, lane lines, words, symbols, and other types of traffic controls.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for thermoplastic pavement markings is on a linear foot basis.

2. Payment for words and symbols is for each word or symbol.

3. Payment for railroad crossing markings, to include stop line and two transverse lines, is for each crossing marked.

a. For multi-lane approaches to railroad crossings, the solid 8-In. lane lines will be measured in linear feet, complete in place.

4. Unit price bid for each item full compensation for furnishing and placing all materials, and for all manipulations, including blast cleaning, surface sealing and priming, labor, tools, equipment, and incidentals necessary to complete work in accordance with drawings and specifications.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM E 28 - Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus.

B. ASTM G 152 - Standard Practice for Operating Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

C. ASTM G 153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

D. TxDOT Tex-822-B - Determining Refraction Index of Glass Beads.

E. TxDOT Tex-826-B - Water Absorption Test of Beads.

F. TxDOT Tex-839-B - Determining Color in Reflective Material.

G. TxDOT Tex-851-B - Evaluating the Abrasion Resistance of Pavement Marking Material.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Product Data: Submit Manufacturer's literature indicating product specifications and instructions for handling, installation, and curing. Include performance test data sheets for each product.

C. Submit material supplier's certification of compliance with specifications.

D. Submit proposed methods, equipment, and sequence of operation for layout, surface preparation, and installation.

E. Chemical Analysis: Submit infrared analysis of Type B resins for each manufacturer used.

PART 2 PRODUCTS

2.01 MATERIAL REQUIREMENTS

A. General Requirements. Especially compound Type B thermoplastic pavement marking material for use on either asphaltic or Portland cement concrete surfaces. Clearly mark each container to indicate color, weight, type of material, and lot or batch number (consider lot or batch as each individual mix or blend that produces finished product ready for use). Package material in either suitable corrugated containers or thermal degradable plastic bags to avoid sticking during shipment or storage.

B. Thermoplastic markings shall not be slippery when wet, nor exhibit tacky, exposed surface. Cold ductility of material shall permit normal road surface expansion and contraction without chipping or cracking. Markings shall retain their original color, dimensions, and placement under normal traffic conditions at road surface temperatures of 158 F and below.

C. Prime and filler pigments shall pass U.S. Standard sieve No. 230 (0.0024-

In. opening) when washed free of resins by solvent washing, and meet following specific requirements for each pigment.

1. Prime Pigments: White pigment shall be Rutile Titanium Dioxide.

2. Filler Pigment: Filler pigment shall be calcium carbonate, 95% purity.

D. Binder

1. Type B - Alkyd: Use binder consisting of mixture of resins, at least one of which is solid at room temperature, and high boiling point plasticizers. At least one-third of binder compositions shall be a maleic-modified glyceryl ester 012 Rosin and shall be no less than 8% by weight of entire material formulation.

E. Glass Traffic Beads: The total silica used in formulation shall be in form of glass traffic beads meeting the following requirements:

1. Manufacture. Use glass traffic beads having the following characteristics:

   a. Manufactured from glass;

   b. Spherical in shape;

   c. Free of sharp angular particles;

   d. Free of particles showing milkiness, surface scoring, or surface scratching;

   e. Water white in color.

2. Contaminants. Use glass traffic beads having the following characteristics:

   a. Containing less than 1/4 of 1% moisture by weight;

   b. Free of trash, dirt, etc;

   c. Showing no evidence of objectionable static electricity when flowing through regular traffic-bead dispenser.

3. Gradation:

   a. Sieve Analysis. Glass traffic beads shall meet following gradation requirements:

Openings U.S. Standard Sieves	Percent Passing
No. 20	95 - 100
No. 30	80 - 95

No. 50	15 - 35
No. 100	0 - 4

b. Irregular Particles: Glass traffic beads, retained on screen used to determine gradation requirements, shall not contain more than 30% (by weight) irregular particles.

4. Index of Refraction: Glass traffic beads, when tested by TxDOT Tex-822-B, using liquid immersion method at 25 C (77 F) shall show index of refraction within range of 1.50 to1.53.

5. Wetting. Use glass traffic beads capable of being readily wet with water when tested in accordance with TxDOT Tex-826-B.

6. Stability. Use glass traffic beads showing no tendency toward decomposition, surface etching, change in retro reflective characteristics, or change in color after:

a. One hour exposure to concentrated hydrochloric acid at 25 C (77 F);

b. Twenty-four-hour exposure to weak alkali;

c. One hundred hours of Weather-O-Meter exposure, in accordance with ASTM G 152 and ASTM G 153.

2.02 FINISHED PRODUCT REQUIREMENTS

A. Physical Characteristics. Finished thermoplastic pavement markings material shall be free flowing granular material, unless otherwise shown on Drawings. Material shall remain in free flowing state in storage at temperatures of 100 F or less. Materials shall be readily sprayed through nozzles commonly used on thermoplastic spray equipment at temperatures between 205 and 218 C (401 to 425 F).

B. Toxicity. At temperatures up to and including 230 C (446 F), materials shall not give off fumes which are toxic and otherwise injurious to persons, animals, or property.

C. Material shall not break down or deteriorate when held at 205 C (401 F) for 4 hours.

D. Temperature versus viscosity characteristics of material in plastic state shall remain constant throughout up to four reheatings at 205 C (401 F) and from batch to batch.

E. Material shall not be adversely altered by contact with sodium chloride, calcium chloride, or other similar chemicals on, or used on, roadway surface; by contact with oil content of pavement materials, or by contact from oil dropping from traffic.

F. Softening Point. After heating thermoplastic materials for two hours at 204 C (400 F) Type B Alkyd material shall have softening point greater than 90 C (194 F) when tested in accordance with ASTM E 28-58T - Ball and Ring Method.

G. Color. CIE chromaticity coordinates of materials, when determined in accordance with TxDOT Tex-839-B, shall fall within area having following corner points and shall meet following luminosity requirements.

Table 1 CIE CHROMATICITY COORDINATE CORNER POINTS

	Point 1	**Point 2**	**Point 3**	**Point 4**	
Color	X Y	X Y	X Y	X Y	X Y
White {tc \12 "White}	0.290– 0.315	0.310 – 0.295	0.350– 0.340	0.330 – 0.360	Min 65

Material shall meet above specified color requirements, before and after 70 hours of exposure in Weather-O-Meter (Atlas, Sunshine Type) fitted with 18 - 102 (18 minutes of sunshine and rain and 102 minutes of sunshine) cyclic gear. Prepare panels for testing with material as supplied.

H. Abrasion. Thermoplastic pavement marking materials shall have loss between 4.0 and 12.0 grams when tested for abrasion in accordance with TxDOT Tex-851-B. Test according to steps 1 through 8 of procedure utilizing following test parameters:

Test distance: 5 inches
Blast pressure: 40 psi
Sample angle: 10 degrees and 122 gram blast media
Blast Media: 1200 grams

I. Uniformity. Manufacture material so that, when sampled in accordance with TxDOT Manual of Testing Procedures, 100-gram sample will be representative of batch or lot of material.

J. When applied 1/8-In. thick, setting time shall not exceed characteristic straight-line curve, lower limit of which is four minutes at 59 F road surface temperatures, and upper limit of which is ten minutes at 90 F road surface temperature. Both temperatures are to be measured at maximum relative humidity of 90%.

2.03 FORMULAE

A. Type B - Alkyd Thermoplastic Marking:

	Pound
Binder	18 - 23
Titanium Dioxide	12 - 15
Calcium Carbonate	20 - 42
Glass Traffic Beads	30 - 45
TOTAL	100

PART 3 EXECUTION

3.01 GENERAL

A. Spray apply pavement marking or extrude hot to pavement surface unless application method is specified on Drawings.

B. Provide continuous mixing and agitation of material. Provide clean, square, marking ends. Do not use pans, aprons, or similar appliances which die overruns.

C. Provide thermometer capable of measuring temperature of pavement marking material.

D. Use automatic bead dispenser attached to pavement marking equipment in manner that beads are dispensed uniformly and almost instantly upon marking as marking is being applied to road surface. Rate of application shall be sufficient to achieve retro-directive reflective characteristics specified. Provide automatic cut-off control for bead dispenser, synchronized with cut-off of pavement marking equipment.

E. Place markings in accordance with approved traffic control plan so that minimal interruption to traffic flow is achieved. Protect newly-installed pavement markings from damage by traffic.

F. Apply pavement markings onto clean, dry pavement having road surface temperature above 60 F for Portland cement concrete surface and above 50 F for asphaltic surface. When pavement marking application is by spray and operations cease for five or more minutes, flush spray head by spraying pavement marking material into pan or similar container until material is proper temperature for application.

G. Use markings that are completely reflectorized internally and externally.

H. Use crew experienced in work of installing pavement markings and supply

all equipment and materials necessary for placement of pavement markings.

I. Apply material within temperature limits recommended by manufacturer.

J. Prior to placement of thermoplastic material, properly prepare pavement with primer.

3.02 LAYOUT

A. Place pavement markings in proper alignment with guidelines established on roadway. Do not deviate from alignment established greater than 2-In. Do not deviate in alignment of marking being placed greater than one inch per 200-Ft. of marking and do not deviate abruption.

B. Place additional markings required to achieve alignment specified throughout both straight and horizontally curved sections of roadway. Additional markings placed on roadway for alignment purposes shall be temporary in nature and shall not establish permanent marking on roadway. Materials used for alignment markings and equipment used to place markings shall be approved by Engineer.

3.03 SURFACE PREPARATION

A. Clean pavement by sandblasting and prepare in accordance with recommendations of thermoplastic material manufacturer and to satisfaction of Engineer, prior to placement of markings. Surface scarification can be used with prior approval of Engineer.

B. Use cleaning methods approved by Engineer that completely remove contaminants, loose materials, and conditions deleterious to proper adhesion. Do not clean Portland cement concrete surfaces by grinding.

C. Prepare Portland cement concrete surfaces further after cleaning by completely sealing with epoxy or methyl methacrylate sealer, as recommended by thermoplastic material manufacturer. Placed sealer sufficiently in advance of thermoplastic to allow release of all solvents.

D. Prime asphaltic surfaces with sealer, as recommended by thermoplastic material manufacturer based on surface conditions. Include adhesive or adhesion promoter when asphaltic surfaces exhibit polished aggregate.

3.04 INSTALLATION

A. Install in widths of 4, 6, 8, or 12-In., or shaped otherwise as shown on Drawings. Tolerances in width shall not exceed 1/8-In. Tolerance shall not exceed ¼-In. in case of undulation in pavement.

B. Material shall not prohibit adhesion of other thermoplastic markings if, at some future time, new markings are placed over existing materials.

C. Maintain uniform thickness of each pavement marking. Minimum thickness of markings, as measured above plane formed by pavement surface, shall not be less than 1/8-In. (125 mils), unless shown otherwise on Drawings. Maximum thickness shall be 3/16-In. Supply device, approved by Engineer, to measure thickness of applied extruded markings.

3.05 TESTING

A. Maintain uniform cross section, density, quality, and thickness for markings. Markings shall be uniform throughout their thickness. Use applied markings that are 95% free of holes and voids, and free of blisters for minimum of 60 days after application.

END OF SECTION

SECTION 02771

CURB, CURB AND GUTTER, AND HEADERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for curbs, curbs and gutter, and esplanade curbs is on linear foot basis measured along face of curb.

2. Payment for mountable concrete curbs is on a linear foot basis.

3. Payment for concrete paving headers and concrete railroad headers is on a linear foot basis.

4. Payment for headers is on linear foot basis measured between lips of gutters adjacent to concrete base and measured between backs of curbs adjacent to concrete pavement.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit details of proposed form work for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Grout: Nonmetallic, nonshrink grout containing no chloride producing agents conforming to following requirements.

1. Compressive strength

a. at 7 days: 3500 psi

b. at 28 days: 8000 psi

2. Initial set time: 45 minutes

3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of
Section 02752 - Concrete Pavement Joints.

F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Public Works.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.02 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to

section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Section 02752 - Concrete Pavement Joints. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves ¼-In. deep using approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.03 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3-Ft. long.

C. Before applying final finish move 10-Ft. straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5-Ft.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with ¼-In. edger. Finish edges with tool having ¼-In. radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.04 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Public Works. Use of mechanical methods shall provide specified curb design and finish.

3.05 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Section 02753 - Concrete Pavement Curing.

3.06 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8-In. from edge of straightedge laid along them, except at grade changes.

3.07 PROTECTION

A. Maintain curbs and gutters in good condition until completion of work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

SECTION 02772

CONCRETE MEDIANS AND DIRECTIONAL ISLANDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement concrete medians and directional islands.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete medians and directional islands is on square yard basis measured from back of curbs.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

D. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Section 02752 - Concrete Pavement Joints.

E. Subgrade Materials: Conform to subgrade material requirements of Section 02330 - Embankment

PART 3 EXECUTION

3.01 SUBGRADE

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill and embankment. Section 02330 - Embankment

3.02 PLACEMENT OF CONCRETE

A. Place and finish concrete in accordance with applicable portions of Section 02751 – Concrete Paving.

3.03 JOINTS

A. Install joints in accordance with Section 02752 - Concrete Pavement Joints.

3.04 CONCRETE CURING

A. Cure concrete in accordance with Section 02753 - Concrete Pavement Curing.

3.05 PROTECTION

A. Maintain concrete medians and directional islands in good condition until completion of work.

B. Replace damaged concrete medians and directional islands to comply with this Section.

END OF SECTION

SECTION 02775

CONCRETE SIDEWALKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforced concrete sidewalks.

B. Wheelchair ramps.

C. Reinforced slope paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete sidewalks is on square yard basis.

2. No payment will be made for work outside these limits or in areas where driveway has been removed or replaced for Contractor's convenience.

3. Payment for wheelchair ramps of each type specified is included in the cost of sidewalk. Removal and replacement of existing sidewalk, curb or curb and gutter and saw-cutting is paid by unit cost for each item. Sodding will be paid 1-Ft. on each side of sidewalk unless otherwise noted. Staining of wheelchair ramps/ADA enhancements is included in cost of sidewalk.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in Field.

B. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and

Sawed Beams of Concrete.

D. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

E. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

F. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

G. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3).

H. Texas Accessibility Standards of Architectural Barriers Act, Article 9102, Texas Civil Statues.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certified testing results and certificates of compliance.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements of Section 02751 - Concrete Paving for reinforcing steel. Use No. 3 reinforcing bars, or 6'' X 6'' No. 6 Welded Wire Mesh.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Forms: Use straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. The use of 2-In. by 4-In. lumber as forms will not be allowed.

F. Sand Bed: Conform to material requirements for bank run sand of Section

02320 – Utility Backfill Materials.

G. Sodding: Conform to material requirements for sodding of Section 02922 - Sodding.

H. Coloring for wheelchair ramps: Conform to material requirements for colored concrete of Section 02761 - Colored Concrete for Medians and Sidewalks. Color shall be Brick Red or as shown on the drawings.

PART 3 EXECUTION

3.01 REPLACEMENT

A. Replace sidewalks and slope paving which are removed or damaged during construction with thickness and width equivalent to one removed or damaged, unless otherwise shown on Drawings. Finish surface (exposed aggregate, brick pavers, etc.) to match existing sidewalk.

B. Provide replaced and new sidewalks with wheelchair ramps when sidewalk intersects curb at street or driveway.

3.02 PREPARATION

A. Identify and protect utilities which are to remain.

B. Protect living trees, other plant growth, and features designated to remain.

C. Conduct clearing and grubbing operations in accordance with Section 02233 - Clearing and Grubbing.

D. Excavate subgrade 6-In. beyond outside lines of sidewalk. Shape to line, grade and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime in accordance with TxDOT Item 260 – Lime Treatment (Road Mix). Compact subgrade to minimum of 95 percent maximum dry density at optimum to 3 percent above optimum moisture content, as determined by ASTM D 698.

E. Immediately after subgrade is prepared, cover with compacted sand bed to depth as shown on Drawings. Lay concrete when sand is moist but not saturated.

3.03 PLACEMENT

A. Setting Forms: Straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. Use of 2 by 4's as forms will not be allowed. Securely stake forms to line and grade. Maintain position during concrete placement.

B. Reinforcement:

1. Install reinforcing bars.

2. Install reinforcing steel as shown on the drawings. Lay longitudinal bars in walk continuously, except through expansion joints.

3. Use sufficient number of chairs to support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.

4. Drill dowels into existing paving, sidewalk and driveways, secure with epoxy, and provide headers as required.

5. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than ¼-In.

C. Expansion Joints: Install expansion joints with load transfer units in accordance with Section 02752 - Concrete Pavement Joints.

D. Place concrete in forms to specified depth and tamp thoroughly with "jitterbug" tamp, or other acceptable method. Bring mortar to surface.

E. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.

F. Apply coating to wheelchair ramp with contrasting color in accordance with Section 02761 - Colored Concrete for Medians and Sidewalks.

G. Unless otherwise indicated on Drawings, mark off sidewalk joints 1/8-In. deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.

H. Finish edges with tool having ¼-In. radius.

I. After concrete has set sufficiently, refill space along sides of sidewalk to one-inch from top of walk with suitable material. Tamp until firm and solid, place sod as applicable. Dispose of excess material in accordance with Section 01576 - Waste Material Disposal. Repair driveways and parking lots damaged by sidewalk excavation in accordance with Section 02951 - Pavement Repair and Resurfacing.

3.04 CURING

A. Conform to requirements of Section 02753 - Concrete Pavement Curing.

3.05 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Compressive Strength Test Specimens: Four test specimens for compressive strength test will be made in accordance with ASTM C 31 for each 30 cubic yards or less of sidewalk that is placed in one day. Two specimens will be tested at 7 days. Remaining two specimens will be tested at 28 days. Specimens will be tested in accordance with ASTM C 39. Minimum compressive strength: 2500 psi at 7 days and 3000 psi at 28 days.

C. Yield test for cement content per cubic yard of concrete will be made in accordance with ASTM C 138. When cement content is found to be less than that specified per cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. If the Contractor places concrete without notifying the laboratory, the City will have the concrete tested by means of core test as specified in ASTM C 42. When concrete does not meet specification, cost of test will be deducted from payment.

E. Sampling of fresh concrete shall be in accordance with ASTM C 172.

F. Take slump tests when cylinders are made and when concrete slump appears excessive.

G. Concrete shall be acceptable when average of two 28 day compression tests is equal to or greater than minimum 28 day strength specified.

H. If either of two tests on field samples is less than average of two tests by more than 10 percent, that entire test shall be considered erratic and not indicative of concrete strength. Core samples will be required of in-place concrete in question.

I. If 28 day laboratory test indicates that concrete of low strength has been placed, test concrete in question by taking cores as directed by Public Works. Take and test at least three representative cores as specified in ASTM C 42 and deduct cost from payment due.

3.06 NONCONFORMING CONCRETE

A. Remove and replace areas that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. Replace nonconforming sections at no additional cost to City.

3.07 PROTECTION

A. Maintain newly place concrete in good condition until completion of work.

B. Replace damaged areas.

END OF SECTION

SECTION 02811

LANDSCAPE IRRIGATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings, valves, sprinkler heads, and accessories.

B. Control system.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for landscape irrigation will be made under this Section on lump sum basis.

2. Payment for capped irrigation sleeve, for connection to future system expansion, is on linear foot basis.

3. Refer to Section 01270 - Measurement and Payment.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 PEFERENCES

A. ANSI/ASTM D 2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

B. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure – Rated Pipe (SDR Series).

1.04 SYSTEM DESCRIPTION

A. Electric solenoid controlled underground irrigation system.

B. Source Power: 120 volt

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in performing work of this section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for piping and component requirements.

1.08 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this Section.

1.09 COORDINATION

A. Coordinate work with site landscape grading and delivery of plant life.

1.10 EXTRA MATERIALS

A. Furnish extra components under provisions of Section 00410 - Bid Form.

1. Two sprinkler heads of each type and size.

2. Two valve box keys.

3. Two wrenches for each type head core and for removing and installing each type head.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Pipe shall be continuously and permanently imprinted with manufacturer's name, size, schedules, type, and working pressure.

B. PVC Pipe ASTM D 2241; 200 psi pressure rated upstream from controls, 160 psi downstream; solvent welded sockets rubber gasket joints.

C. Fittings: Type and style of connection to match pipe.

D. Solvent Cement: ANSI/ASTM D 2564 for PVC pipe and fittings.

E. Sleeve material: 4-In. schedule 40 PVC.

2.02 OUTLETS

A. Manufacturer's or approved equal:

1. Rainbird Model 1804.

2. Rainbird Model 1812

3. Hunter Model PGP

B. Rotary type sprinkler head: Pop-up type with screens; fully adjustable for flow and pressure; size as indicated; with letter or symbol designating degree of arc and arrow indicating center of spray pattern.

C. Spray Type Sprinkler Head: Pop-up head with full circle, half circle, third circle, quarter circle, and square pattern.

2.03 VALVES

A. Manufacturer's or approved equal:

1. Rainbird Model PEB Series

B. Gate Valves: Bronze construction, non-rising stem, and sized to line.

C. Backflow Preventers: FEBCO 765 Bronze body construction, reduced pressure zone or pressure vacuum breaker type.

D. Valve Box and Cover: rectangular 10-In. by 4-In. or 9-In. round.

2.04 CONTROLLER

A. Manufacturer's or approved equal:

1. Rainbird Model RC1260C

B. Valves: Electric solenoid wiring including required fittings and accessories.

C. Wire conductors: color coded.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions under provisions of Section 01312 - Coordination and Meetings.

B. Verify location of existing utilities.

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

3.02 PREPARATION

A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.

B. Layout and stake locations of system components.

C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 TRENCHING

A. Trench and filling as required.

B. Trench size:

1. Minimum cover over installed supply piping: 18-In..

2. Minimum cover over installed branch piping: 12-In.

3. Minimum cover over installed outlet piping: 12-In.

C. Trench to accommodate grade changes.

D. Maintain trenches free of debris, material, or obstructions that may damage pipe.

E. Do not leave trenches open overnight.

3.04 INSTALLATION

A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.

B. Connect to utilities.

C. Set outlets and box covers at finish grade elevations.

D. Install control wiring as required. Provide 10-In. expansion coil at each valve to which controls are connected, and at 100-Ft. intervals. Bury wire beside pipe. Mark valves with neoprene valve markers containing locking device. Set valve markers in 160 psi PVC pipe risers exiting from top of valve to finish grade.

E. After piping is installed, but before outlets are installed and filling commences, open valves and flush system with full head of water.

F. Coordinate pipe installation with conduit installation.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Prior to filling, test system for leakage for whole system to maintain 100 psi pressure for one hour.

3.06 FILLING

A. Cover with 3-In. of sand over piping; fill trench and compact to subgrade elevation. Protect piping from displacement.

3.07 ADJUSTING

A. Adjust control system to achieve time cycles required.

B. Change and adjust head types for full water coverage as directed.

3.08 DEMONSTRATION

A. Demonstrate system under provisions of Section 01755 - Starting Systems.

B. Instruct City's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance material as basis for demonstration.

END OF SECTION

SECTION 02834

SEGMENTAL CONCRETE RETAINING WALL SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work includes furnishing and constructing a segmental concrete retaining wall (SRW) system, including leveling pad, soil reinforcement, unit drainage fill, reinforced backfill, and incidental materials required for SRW construction to the lines and grades shown on the construction drawings and specified herein.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Measurement - The unit of measurement for furnishing and fabricating the SRW shall be the vertical square foot of wall surface from the top of the leveling pad to the top of the wall or wall coping.

2. Payment - The accepted quantities of SRW will be paid at the contract unit price, which shall be full compensation for design, supply, and installation of the SRW including face units, caps, leveling pad, unit drainage fill, soil reinforcement and reinforced backfill.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 Reference Standards

A. ASTM C1372 Specification for Segmental Retaining Wall Units

B. ASTM D422 Particle Size Analysis

C. ASTM D698 Laboratory Compaction Characteristics of Soil -Standard Effort

D. ASTM D1388 Stiffness of Fabrics

E. ASTM D2166 Unconfined Compressive Strength of Cohesive Soil

F. ASTM D3034 Polyvinyl Chloride Pipe (PVC)

G. ASTM D3080 Direct Shear Test of Soils

H. ASTM D4218 Carbon Black Content

I. ASTM D4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils

J. ASTM D4475 Horizontal Shear Strength of Pultruded Reinforced Plastic Rods

K. ASTM D4595 Tensile Properties of Geotextiles - Wide Width Strip

L. ASTM D5262 Unconfined Tension Creep Behavior of Geosynthetics

M. ASTM D6638 Connection Strength – Reinforcement/Segmental Units

N.. ASTM D6916 Shear Strength Between Segmental Concrete Units

O.. ASTM G51 Measuring pH of Soils

P. ASTM G57 Measurement of Soil Resistivity

Q. GRI-GG2 Determination of Geogrid Junction Strength

R. GRI-GG4 Determination of Long Term Design Strength of Geogrids

S. GRI-GG5 Determination of Geogrid (soil) Pullout

T. GRI-GG7 Determination of Carboxyl End Group Content

U. GRI-GG8 Determination of the Number Average Molecular Weight

V. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW

X. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW

Y. Standard Specifications for Highway Bridges, 17th Edition, 2002

X. AASHTO M 252 Corrugated Polyethylene Drainage Pipe

AA. AASHTO M 288-96 Specifications for Geotextiles

1.04 DEFINITIONS

A. Segmental Concrete Units - a modular concrete facing unit machine made from Portland cement, water and mineral aggregates.

B. Soil Reinforcement - geosynthetic or steel reinforcement formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock or earth and function as reinforcement. Soil reinforcement shall be specifically manufactured for soil reinforcement.

C. Unit Drainage Fill - drainage aggregate that is placed within and behind the segmental concrete units.

D. Reinforced Backfill - compacted soil that is within the reinforced soil volume as shown on the plans.

E. Foundation Soil – compacted, imported or in-situ soil beneath entire wall.

F. Retained Soil – compacted, imported or in-situ soil behind reinforced zone of the retaining wall.

1.05 SUBMITTALS

A. A set of detailed SRW design plans sealed by a registered professional engineer licensed in the state of the project. The SRW plans shall include plan and elevation views of each wall, cross sections and all details, dimensions and quantities necessary to construct the SRW.

B. Product literature indicating specifically which SRW units and soil reinforcement are proposed for use on the project including color, face style and texture.

C. Documentation for the SRW units and soil reinforcement demonstrating compliance with the requirements of this specification including but not limited to SRW compressive strength and absorption; SRW/soil reinforcement connection and shear; and reinforcement strength.

D. Manufacturer's certification that the SRW units and soil reinforcement meet the requirements of this specification.

PART 2 PRODUCTS

2.01 DESIGN METHOD

A. Design of SRW's using geosynthetic reinforcement shall be in accordance with the NCMA Design Guidelines for Segmental Walls, AASHTO or NCMA utilizing AASHTO earth pressure and stability design criteria. Metallic reinforcement systems shall be designed in accordance with AASHTO Standard Specification for Highway Bridges, Section 5.8, using the Coherent Gravity Method. All designs shall conform to the minimum safety factors in this Specification. Design submittals not meeting this design criteria or technical/administrative criteria specified will be rejected in their entirety until complete compliance is achieved.

B. Design Parameters - The design of the SRW system shall be based on the following soil parameters provided by a geotechnical report.

C. Design Requirements - Unless otherwise indicated below, the SRW design shall be performed in strict compliance with this Specification.

Internal Stability	**Minimum Factor of Safety**
Tension (Peak)	1.5
Pullout (Peak	1.5
Facing Connection (Peak/serviceability)	1.5/NA
Facing Shear (Peak/serviceability)	1.5/NA
External Stability	**Minimum Factor of Safety**
Base Sliding (static)	1.5
Overturning	2.0
Bearing	2.0

D. In addition, to further clarify the Owner's intent, the design shall:

1. Address hydrostatic, seismic, surcharge and backslope loading as shown on the plans. Minimum live loads of 100 psf (4.8 kPa) and 250 psf (12 kPa) shall be for all walls and walls supporting areas subject to traffic, respectively.

2. Provide a minimum reinforcement length of 60% the total height of the wall for each layer or longer as required by calculation.

   Provide continuous, 100% geosynthetic coverage at each reinforcement layer (no gaps).

   Use a maximum spacing between vertically adjacent reinforcing layers of no more than 2 times the actual (not nominal) SRW unit depth (face to tail).

   Only the weight of the mass vertically over the plane of sliding shall be included in the resisting forces for sliding and overturning.

2.02 BASE LEVELING PAD

A. level compacted gravel or unreinforced concrete pad upon which the first course of segmental concrete facing units is placed.

2.03 SEGMENTAL CONCRETE UNITS

A. Modular concrete unit face color as shown on the drawings or as determined by the City. Finish (smooth or split face or otherwise will be as shown on the drawings or as determined by the City .

B. Manufactured in accordance with ASTM C1372 with a minimum 28-day compressive strength of 3000 psi (21 MPa) (4000 psi (28 MPa) for steel reinforced systems) and a maximum moisture absorption of 8% (6% in northern climates).

C. Provide shear pins or connection devices to provide a mechanical connection between vertically and horizontally adjacent units so as to provide at a 2 psi (13 kPa) normal pressure a minimum inter-unit shear strength of 600 plf (8 kN/m) per ASTM D6916 (NCMA SRWU-2) and a geosynthetic to SRW unit peak connection strength of 500 plf (7 kN/m) per ASTM D6638 (NCMA SRWU-1). Shear devices shall protrude at least 7/8 inch (22 mm) into receiving openings of the SRW units. At least one shear connector is required per linear foot (300 mm) of wall for each course. The shear connector must fit within an aperture of the soil reinforcement and be capable of holding the reinforcement in the proper position during tensioning and backfilling. Connectors shall result in a design wall batter of 1º to 10º.

2.04 SOIL REINFORCEMENT

A. Furnish earth reinforcements that meet the design requirements. For permanent walls, galvanize or epoxy coat all steel elements in contact with soil. Epoxy coat with a minimum 18-mil coating thickness. Epoxy coat the reinforcing only when shown in the plans or as approved. When using nonmetallic or epoxy coated earth reinforcements, use connection hardware that is likewise nonmetallic or epoxy coated.

2.05 DRAINAGE AGGREGATE

A. Use drainage aggregate to fill the void within concrete block units and in the zone 1 ft. behind the units. Provide drainage aggregate that is free from organic or otherwise deleterious materials and that conforms to the gradation limits in below as determined by Tex-110-E..

Drainage Aggregate Gradation Limits

Sieve Size	Percent Retained
1 in.	0
3/4 in.	25–50
1/2 in.	50–100
No. 4	75–100

2.06 REINFORCED BACKFILL

A. Shall consist of soil with less than 35% passing the No. 200 sieve per ASTM D422 with a maximum size of 3/4 inches (19 mm) (4 inch (100 mm) maximum for steel reinforced systems). If site-specific geogrid installation damage testing has been performed to determine RFID, the maximum size may be increased to 2” (50mm);

B. A plasticity index less than 10 per ASTM D4318;

1. An effective internal angle of friction $\geq$ 30º per ASTM D2166 or D3080 at the compaction standard;

C. Less than 0.5% organic material;

1. Material can be site-excavated soils where the above requirements can be met. Unsuitable soils for backfill including ML, CL, MH, CH, OH or Pt shall not be used in the backfill or in the reinforced soil mass.

D. Use of an effective friction angle greater than 30 degrees for design shall be verified by appropriate testing submitted to and approved by the owner’s engineer prior to construction.

C. Backfill reinforced with geosynthetic shall have a pH in the range of 3 to 9 per ASTM G51.

D. Backfill reinforced with steel reinforcement shall have a pH in the range of 5 to 10 per ASTM G51, minimum resistivity of 3000 ohm-cm at 100% saturation per ASTM G57 and free of sulfates > 200 ppm or chlorides > 100 ppm. If the resistivity is ≥ 5000 ohm-cm, the chloride and sulphate requirements are waived. Subject to approval, the owner's engineer may allow slightly wider ranges of pH for higher resistivities.

2.07 BASE LEVELING PAD

A. Base leveling pad shall be constructed of dense graded crushed stone or crushed gravel. A concrete leveling pad consisting of lean unreinforced concrete may be used at the wall contractor's option.

2.08 Delivery, Storage and Handling

A. The contractor shall check all materials upon delivery to assure that the proper type, grade, color and material certification have been received. Contractor shall protect materials from damage due to jobsite conditions and in accordance with the manufacturer's recommendations. Damaged materials shall not be incorporated into the work.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. General – Construction and construction tolerances shall be in accordance with NCMA Section 6 and 7 or AASHTO Section 7 with the following additions or clarifications.

B. Place the concrete block facing units in accordance with the approved working drawings. Fill the voids within the units and fill the 1-ft. zone immediately behind the facing with drainage aggregate . Systems tested without unit fill may omit the fill as indicated on the approved drawings. Systems with approved filter fabric details may omit the drainage aggregate in the 1-ft. zone immediately behind the facing

C. Compact backfill to provide not less than 95% of density determined in accordance with Tex-114-E. Field density determination will be made in accordance with Tex-115-E. Sprinkle backfill as required to ensure adequate uniformly distributed moisture in each lift prior to and during compaction. Place fill in lifts of 8 in. or less (loose measurement). Place fill in a manner that avoids segregation of the fill. Decrease the lift thickness if necessary to obtain the required compaction. Use hand-operated or walk-behind compaction equipment in the 3-ft. wide strip adjacent to the wall panels. Do not displace panels or distort or damage the reinforcement system during compaction. Modify backfill material, placement, and compaction methods as necessary to meet density requirements while maintaining wall tolerances.

D. For walls using earth reinforcements, place reinforcements and backfill. Pay particular attention to the connection details of the earth reinforcements to the concrete block units.

3.02 Field Quality Control and Assurance

A. Field Quality Assurance - The Owner shall engage inspection and testing services, including independent laboratories, to provide quality assurance and testing services during construction. As a minimum, quality assurance testing should include foundation soil inspection, inspection for the need for any additional drainage, soil and backfill testing, verification of design parameters, and observation of construction for general compliance with design drawings and specifications. This does not relieve the Contractor from securing the necessary construction quality control testing during construction.

B. Field Quality Control - The Contractor's quality control testing and construction inspection services shall only be performed by independent, qualified and experienced technicians and engineers. The Contractor's quality control testing, as a minimum, shall include:

1. Field density testing

a. Subgrade: one test for every 2500 square feet of subgrade.

b. Reinforced Backfill: one test for every 2500 square feet per lift with a minimum of one test for every other lift.

c. Retained and Foundation Soil: per Section 02330.

END SECTION

SECTION 02893

TRAFFIC SIGNAL CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This specification consists of the requirements to construct traffic signals in the City of Schertz.

1.02 UNIT PRICES

B. Unit Prices

Items discussed in this specification shall be measured separately from the unit price items identified in Bid Proposal - Schedule or Unit Price Work. Items and work processes discussed in this section are incidental to furnishing and installing a functioning traffic signal.

No separate payment shall be made for Traffic Signal Construction under this Section. Payment will be included under various unit price items included in Bid Proposal - Schedule of Unit Price Work.

1. Measurement and payment of traffic signal items shall be per each unit furnished and installed complete and in place with all appurtenances.

2. Payment for traffic control devices will be on the basis of each device installed as shown on the drawings or as directed by the City Engineer and/or the approved City of Schertz Representative.

3. Refer to Section 01270 – Measurement and Payment for unit price procedures.

C. Stipulated Price per Intersection (Lump Sum) If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SPECIAL REQUIREMENTS

The requirements of this contract encompass the construction of new traffic signal installations either installed 1.) concurrent with the street or roadway improvement phases of the work so that the signals will be in operation at the time the intersection is open to traffic, or 2.) as traffic signal or traffic signal related improvements.

The purpose and intent of this specification is for the Contractor to furnish all labor, materials, tools, equipment, tests, adjustments and all other incidentals necessary to install and/or modify a traffic signal system. The Contractor shall also install items furnished by the City of Schertz, specified herein. All materials and equipment furnished for installation under this contract shall be new and unused, unless otherwise specified. Contractor shall furnish and install or install materials as specified herein.

All bidders shall visit the job site prior to bidding in order to acquaint themselves with all job site conditions and problems, if any, and all other factors that may affect the bid on all project specific contracts. On work order type projects all bidders shall thoroughly familiarize themselves with City of Schertz requirements and general field conditions. Any discrepancy between drawings and specifications shall be resolved prior to bidding.

These specifications together with the reference Drawings and Contract Documents require the furnishings of all superintendence, labor, tools, equipment and apparatus necessary for the complete working system of the traffic signal installation(s). All submittals need to be pre-approved prior to the job and by the inspector as directed by the Engineer and/or the approved City of Schertz Representative.

Call Public Works, 210-619-1800 for coordination and inspection of traffic signal work.

All control equipment shall confirm to ITE and NEMA specifications and in accordance with the drawings and specifications.

All construction will be in accordance with the Texas Manual on Uniform Traffic Control Devices, latest revisions, and in accordance with the drawings and specifications.

All wiring throughout each traffic signal installation shall be in strict accordance with the National Electric Code, all local applicable codes and shall also comply with all requirements of the appropriate power provider, in order that service may be obtained from them. All costs for code compliance are to be included in the bid for this contract.

1.04 1.04 REFERENCES

A. References: References to known standard specifications in the Specification shall mean and intend latest edition of such specification adopted and published at date of invitation to submit Proposals.

B. Reference to technical society, organization or body is made in Specifications in accordance with the following abbreviations:

	AASHO	American Association of State Highway Officials
	ACI	American Concrete Institute
*	AIEE	American Institute of Electrical Engineers
	AISC	American Institute of Steel Construction
	AISI	American Iron and Steel Institute
	ASA	American Standards Association
	ASTM	American Society for Testing and Materials
	AWSC	American Welding Society Code
	FS	Federal Specification
	IMSA	International Municipal Signal Association
	IPCEA	Insulated Power Cable Engineers Association
	ITE	Institute of Traffic Engineers
	MUTCD	Manual on Uniform Traffic Control Devices for Streets and Highways
	NBFU	National Board of Fire Underwriters
	NBS	National Bureau of Standards
	NEC	National Electrical Code
	NEMA	National Electrical Manufacturers Association
	OSHA	Occupational Safety and Health Association
	UL	Underwriters' Laboratories
*	IEEE	Institute of Electrical and Electronics Engineers - name changed from AIEE & IRE (Institute of Radio Engineers)

1.05 PERMITS, LAWS, CODES, ETC.

The contractor and subcontractors shall comply with all Federal, State and local Laws, Codes and Ordinances applicable to the work and all requirements of the National board of Fire Underwriters having jurisdiction. If the above laws, codes or ordinances conflict with specification, then the laws, codes or ordinances shall govern except where Specification exceeds them in quality of quantity of materials or labor. Obtain and pay for all permits required in connection with the execution of the work as required. The Engineer and/or the approved City of Schertz Representative shall be furnished with certified copies of these permits if he so requests.

1.06 COOPERATION WITH BUILDING OFFICIALS

Cooperate with local and other governmental officials and inspectors at all times. If such official or inspector deems special inspection necessary, provide assistance and facilities that will expedite his inspection. Any materials and or workmanship which are rejected by the Traffic Signal Inspector by reason of

failure to conform to the requirements of the drawings or specifications, shall be removed and replaced by the contractor at his own expense.

1.07 SUBSTITUTIONS

A. Except in special instances, the Technical Sections of these specifications list more than one manufacturer of the products specified. Products of listed manufacturers conform basically to design and performance requirements as indicated on the Drawings and specified herein and Contractor in proposing their use shall indicate by detail drawings and/or descriptive data any modifications of items or assemblies necessary to provide the indicated and/or specified work.

B. Requests for substitutions of materials must be submitted in writing to the Engineer and/or the approved City of Schertz Representative by the Contractor. These substitutions will only be considered if fewer than three manufacturers are listed in the Specifications.

C. Under no circumstances will the Engineer and/or the approved City of Schertz Representative be required to provide that a product proposed for substitution is, or is not, of equal quality to the product specified. It is mandatory that the Contractor submit to the Engineer and/or the approved City of Schertz Representative, in Writing, all evidence necessary to support this contention that the item proposed for substitution is equal to the item indicated by the Contract Documents. Items submitted for substitution must be submitted one month prior to bid opening.

1.08 MANUFACTURER'S SPECIFICATION AND INSTRUCTIONS

Install all manufactured items, materials and equipment in strict accordance with the manufacturer's recommended specifications except that the Specifications herein, where more stringent, shall be complied with.

1.09 MEASUREMENTS

Before doing any work or ordering any materials, the Contractor and Subcontractors shall verify all measurements of existing and new work and shall be responsible for their correctness. Any difference which may be found shall be submitted to the Engineer and/or the approved City of Schertz Representative for consideration before proceeding with the work. No extra compensation will be allowed because of differences between actual dimensions and measurements indicated on the drawings.

1.10 RECORD DRAWINGS

Provide and maintain in proper order and in good, clean condition at the project sites, one complete set of prints of all project drawings. On this set of drawings

Contractor shall neatly print and accurately inscribe, in red pencil, any and all changes or deviations from construction and installation as originally indicated in the plans and specifications. This set of prints shall be delivered to City of Schertz PUBLIC WORKS at the time of final acceptance of the work by the City in order to provide the City with an "AS BUILT" set of plans.

1.11 TEMPORARY FACILITIES

A. Weather Protection

1. Contractor shall at all times provide protection against weather, so as to maintain all work, materials, apparatus, and fixtures free from injury and damages. At the end of the day's work, all new work likely to be damaged shall be covered or otherwise protected.

2. Wet work shall not be performed when temperature is below 40˚ F, or is likely to go below 40˚ F, within the ensuing 48 hours, except when sufficient protective heat is provided and the Engineer's and/or the approved City of Schertz Representative's approval in writing is obtained.

3. Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations, pits and trenches free of water.

B. Operation of Equipment

When electrical or other equipment is installed, it shall be the responsibility of the Contractor to check out same for a period of time as required by the Engineer and/or the approved City of Schertz Representative for proper testing of the equipment. All items of equipment, testing instruments and incidentals necessary for proper testing of equipment shall be furnished by Contractor.

C. When any temporary facility is no longer needed for the proper conduct of the work as determined by the Engineer and/or the approved City of Schertz Representative, the Contractor shall completely remove it from the project and shall repair or replace all material, equipment and finished surfaces damaged in doing so.

D. Contractor shall provide a portable toilet as needed.

1.12 PROTECTION

Provide barricades, fences, lights, etc., for protection of property and the public as required by local and/or State Ordinances. Contractor will be held liable for all damage to property and/or persons.

A. All barricades and signs shall conform to Texas MUTCD. Such barricades and protective signs shall be provided by the Contractor at his expense.

B. Flow of traffic shall not be interrupted completely without the approval of the Engineer and/or the approved City of Schertz Representative. Restriction and minor diversion will be kept to a minimum. No work will be permitted in the traffic lanes during peak hours from **7:00 to 9:00 AM and 4:00 to 6:00 PM Monday through Friday**. Any open cuts in the intersections during these hours will be covered with steel plates to maintain uninterrupted traffic.

C. Flag-men shall be certified flag-men or off-duty uniformed peace officers of the law. Contractor shall provide flag-men to direct traffic when directed by the Area Engineer and/or the approved City of Schertz Representative of the Traffic Management and Maintenance Division. This does not relieve Contractor of responsibility of taking other steps and providing other personnel who he may deem necessary for protection of work and public.

D. Appropriate Personal Protective Equipment shall be worn by all contract personnel when on the job-site.

1.13 RESTORING DAMAGED AREAS

For all work at identified intersections and along communication cable routing, in the event that sidewalks, pavement, curbs, wheelchair ramps, driveways, landscaped areas, areas with special pavement treatment, sprinkler systems, lighting systems, or other items or properties both public and private that are damaged during this construction, shall be restored to their prior condition without expense to the City of Schertz. No separate payment will be made for the restoration of these items.

Where signal poles are installed inside the existing 4 foot sidewalk or within 12 inches of either side of the existing sidewalk, the Contractor shall provide a minimum of 4 foot paved sidewalk 12 inches away from edge of the signal pole. The horizontal slope for the sidewalk shall be 2 percent.

PART 2 PRODUCTS

2.01 MATERIALS

Contractor is responsible for furnishing all materials and labor for construction of items as shown on drawings and other incidentals necessary to provide a fully operational traffic control signal. The Contractor shall furnish and install all materials, with exception of materials to be provided by the City of Schertz.

Material should be installed according to the technical specifications and standard details under the direction of the City of Schertz representative assigned to the project.

In addition to all items to be furnished and installed by the Contractor, the Contractor shall furnish and install all items necessary for the complete signal system including but not limited to the following incidental materials:

- All conduit nipples, couplings, grounding bushings, elbows, sweeps and service heads.
- All reinforcing steel and ties.
- Concrete, sand, cement, gravel, asphalt, earth fill.
- Span guy, down guys, anchor rod assemblies.
- Sidewalk guy assemblies (if necessary).
- Guy guards, three bolts clamps, lag screws.
- 5/8” Thru-bolts, nuts, washers, thimble-eye nuts and bolts.
- 5/16” Stranded galvanized steel cable for guys and catenaries.
- ¼’ Stranded galvanized steel cable for messengers.
- Strand vises and links as needed.
- Meter loop assemblies complete.
- Signal mounting hardware.
- Copperweld ground rods and clamps furnished and installed in all foundations and each pullbox.
- Flexible stainless steel cable strap ties. Cable ties shall be Panduit Part #MLT 4H-LP or equivalent.
- #6 or #8 Soft bare copper wire for grounding poles, conduits, etc.
- Miscellaneous hardware.

Interconnect cable shall be communications grades as follows:

- Type PE-38 or PE-22 (aerial)
- Type PE-39 (underground)

All proposed changes in the signalization plan must be submitted to the City of Schertz, in writing, for approval.

The Contractor shall be responsible for the protection of all present utilities that have been located by the various utility companies. He shall also maintain and protect the existing traffic signals and their related equipment from damage caused by subcontractors and employees under his Contract but only to the extent of the Contractor’s normal work operation, and he shall not be responsible for routine maintenance, normal wear and tear or an act of God, unless otherwise specified.

The contractor shall bag all newly installed signal heads and/or pedestrian signal heads with burlap until final inspection and acceptance by the City of Schertz

Representative. The signal shall be wrapped with burlap at least twice so that the entire signal head is covered, and cannot be seen until it is placed in operation. The signal shall be de-energized while not in use. If, in the opinion of the Engineer and/or the approved City of Schertz Representative, the new heads would create a hazard condition to motorists and/or pedestrians, the heads shall not be installed until one hour before turn on the new equipment.

All existing traffic signal equipment removed by the Contractor shall be tagged to identify location. A representative of Traffic Signal Engineering and Operations shall be given **24 hour** notice before delivery of an approval location by the Engineer and/or the approved City of Schertz Representative. Equipment not identified will not be accepted and equipment not returned will result in the withholding of payment to the Contractor. Traffic Signal Engineering and Operations personnel will issue a receipt to Contractor for returned equipment.

When the City Traffic Engineer and/or the approved City of Schertz Representative determines that the need for a traffic signal is critical to the public welfare, early "turn on" of the signal shall be required before the completion of the project. If the need arises, the City of Schertz will assume the responsibility for maintenance and liability, or negotiate with the Contractor for maintenance and liability for such a signal.

The City Traffic Engineer and/or the approved City of Schertz Representative may, at any time, authorize City of Schertz personnel to enter the controller cabinet in order to restore any and all signal equipment to proper operation if the malfunction or non-function of such equipment poses a hazard or inconvenience to motorists or pedestrians. Such authorized entry may occur at any time within the period of the Contract and such authorized entry shall in no way relieve the Contractor or manufacture of his respective warranties.

During the burn-in period, the Contractor shall restore operation of the installation within **four (4) hours** after notification of a malfunction. If the Contractor does not respond within **four (4) hours**, the City of Schertz shall have the option of making the necessary repair and billing the Contractor for the actual time and materials required.

When replacing sidewalks or curb and gutters, it shall be the responsibility of the Contractor to reinstall them to match existing color and/or surface texture.

Materials specified herein shall be installed as per Traffic and Transportation Construction Details drawings-3900 series and the City of Schertz Traffic Signal Standard Specifications.
Each work order or intersection shall be a stand alone "Turn Key Job" by the Contractor.

A steel template of the proper dimensions shall be furnished and used by the Contractor to secure anchor bolts while constructing pole foundations.

Flexible stainless steel cable ties for strapping signal cable to messenger shall be min: 13.38 inches long, 120 lb. min. tensile holding strength, 3/16" to 3-1/2" wire bundle range. (Panduit Part #MLT 4H-LP or approved equal).

2.02 PRECONSTRUCTION MEETING

The Traffic & Transportation Division for Traffic Signal Contracts shall schedule a Preconstruction Meeting at Public Works after award of contract and prior to commencement of construction. The Contractor or his authorized representative will be required to attend.

For roadway contracts, the preconstruction meeting for the traffic signal work shall be coordinated by Public Works.

2.03 MATERIALS FURNISHED BY THE CITY

Prior to material pick up, a written notice is required sixty (60) calendar days in advance. This letter shall be addressed to:

City of Schertz
Public Works
10 Commercial Place, Bldg #2
Schertz, Texas 78154

Materials furnished by the City shall be picked up by the Contractor at the Public Works yard, Schertz, Texas, after giving a minimum of two (2) working days notice to the Construction Inspection Superintendent. This is in addition to the written requirements listed above. These materials will be furnished at no cost to the Contractor.

Any and all material furnished by the City to the Contractor which is not used in this contract is the property of the City of Schertz and shall be returned to the locations specified by the Traffic Signal Inspector before final payment is made to the contractor.

2.04 PRODUCT DATA, SHOP DRAWINGS, AND SAMPLES

Contractor shall provide **three (3)** complete bound sets of Product Data, including: illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate materials or equipment for all Contractor furnished equipment.

Contractor shall furnish shop drawings, as required in the standard specifications and standard details, or as required by the Engineer and/or the approved City of Schertz

Representative. As a minimum, Contractor shall be required to furnish shop drawings for all structural elements, including cabinets, traffic signal poles, traffic signal arms, luminaires, luminaire supports, vehicular traffic signal head mounts, and pedestrian signal head mounts **prior** to ordering or fabricating these elements. Shop drawing submittals are required for each of the preceding elements. Contractor is not required to furnish shop drawings for any equipment furnished by the City of Schertz.

Contractor shall furnish samples, or prototypes, of the following equipment within the specified time frame.

Item	Calendar Days from Bid Award
Controller Cabinet Assembly	45
Traffic Signal Controllers	60

PART 3 EXECUTION

3.01 OPERATION OF NEW & EXISTING TRAFFIC SIGNALS DURING CONTRACT PERIOD

To facilitate construction, the Contractor shall be required to install temporary poles, guys, cables, signals, conduits, wiring and adjustments as needed for temporary traffic signal operation during construction. **The Contractor will be responsible for furnishing and installing all materials as directed by the City of Schertz Signal Inspector for temporary traffic signal installation.** The Contractor shall contact the signal inspector assigned to the project with a daily progress report. The Contractor shall coordinate and obtain approval from the City of Schertz signal inspector for all material as well as the configuration of the temporary traffic signal prior to installation. Proposed configurations and materials for the temporary traffic signal installation shall be submitted to the City of Schertz Traffic Signal Engineering and Operations **no less than five (5) working days** prior to implementation. Operational timing and phasing of the temporary traffic signal installation during construction will be the responsibility of the City of Schertz Traffic Management & Maintenance Branch personnel. Temporary traffic signal work will not be paid for directly, but shall be considered incidental to Traffic Control during construction. All temporary facilities shall be removed as directed by the signal inspector and remain the property of the Contractor upon operation of the new traffic signal construction.

The Contractor shall maintain existing signal installation(s) operational during construction of the new signal system. The Contractor may be required to photograph the existing signal to document existing status and functionality of all signal hardware and devices before beginning construction. It is the Contractor's responsibility to maintain all existing signal hardware and devices including signal

heads and bulbs, interconnect, pedestrian elements, etc. The Contractor will not be responsible for power consumption of the signal during construction, and for work with the controller or inside the cabinet unless a city representative is onsite or as directed otherwise by the City of Schertz. The Contractor shall submit all existing intersection documentation to the City Inspector for the project before commencing work. The Contractor shall respond within **two (2) hours** after notification from appropriate City of Schertz personnel. If the Contractor does not respond, the City of Schertz will make necessary repairs and bill the contractor at an overtime rate (1.5X) for work performed.

The Contractor shall provide a minimum of five (5) working days notice to City of Schertz representative at 210-619-1800 when seeking approval for a change in location, method of operation of traffic signals or traffic lanes, or change in traffic patterns or timing plans.

The Contractor shall provide a minimum of two (2) days notice when seeking approval regarding the replacement of an existing traffic signal installation.

The Signal Contractor shall be billed for any repair work performed on overtime (1.5X) for any repairs required because of Contractor negligence.

Uniformed Police Officers shall be employed by the contractor and are required to be on the job site. It shall be mandatory to have Uniformed Police Officer(s) for traffic signal turn-ons. Certified flagmen or Uniformed Police Officers may be used, as needed, for lane closures. It is the Contractor's responsibility to use the appropriate personnel for lane closures. The Texas Manual on Uniform Traffic Control Devices will be observed for all lane closures.

All work in this contract, requiring signal outages, or lane closures, shall be performed **between the hours of 9:00 A.M. and 4:00 P.M. Monday through Friday**, unless prior authorization has been obtained from the Engineer and/or the approved City of Schertz Representative.

Down time, if any, shall be kept to an absolute minimum. The switch over from the old system, or signal turn-on, shall be accomplished within the **six (6) hours between 9:00 A.M. and 3:00 P.M.** Contractor shall furnish and install all temporary traffic control (stop signs, flagmen, uniformed officers, etc.) during any down time, in addition to all required construction signs. Contractor shall inform the City of Schertz to schedule a turn-on date **a minimum of 72 hours** in advance of need.

The Contractor shall hire a traffic engineer approved by the City of Schertz to implement the traffic signal timings for the temporary signal system(s) and any modifications to the traffic control plan.

The Contractor shall furnish the City of Schertz with a 24-hour telephone number for the purpose of forwarding malfunction calls. In the event that the Contractor

cannot be reached at the above mentioned number, the City of Schertz will take the necessary action to restore the traffic signal system to normal operation and all expenses incurred will be deducted from the final payment of the work order. All City of Schertz labor expense shall be billed at overtime (1.5X) rates.

Contractor will be required to respond immediately and to initiate emergency maintenance operations on the jobsite a **maximum of four (4) hours** after the call is received from City of Schertz. The Contractor shall pursue repairs to the traffic signal system and have it back in normal operation within a **maximum of six (6) hours** after call is received by the City of Schertz, or a representative of the City of Schertz.

3.02 CHARACTER OF WORKMEN AND EQUIPMENT

All equipment and workmen provided by the contractor for work hereunder shall be the best available for the kind of work being performed. Any person employed by the Contractor whom the City of Schertz may deem temporarily or permanently incompetent or unfit to perform the work, shall under written instruction of the Engineer and/or the approved City of Schertz Representative be removed from the job, and such person shall not again be employed on the work. Failure by the Contractor to provide adequate equipment may result in annulment of this contract as herein provided.

3.03 LICENSED ELECTRICIANS

A master electrician currently registered with the Building Inspections Department of the City of Schertz is required to supervise all electrical work performed on this project by the contractor. The master electrician shall be available upon request to report to the job site.

A journeyman electrician shall be on the job site or within sight, hereby defined as 300 feet, of jobsite, when electrical work is being performed.

3.04 ELECTRICAL WORK

Electrical work is defined as installing cables, electrical terminations, and signal turn-ons. Connection of loop leads to homerun cables is considered electrical termination and shall require a journeyman electrician. Installation of conduits is EXCLUDED from electrical work. Installation of loop wire in sawcut is EXCLUDED from electrical work.

All electrical work shall be by journeyman electricians (or apprentice electricians being supervised by journeyman electricians) having current City of Schertz journeyman electrician license card on their person for verification by either the City's Electrical Inspector or the City's Traffic Signal Inspector. All Contractor personnel working on City of Schertz traffic signals performing duties directly involving setting up or installing signs, signals, pushbuttons, or traffic control shall

be International Municipal Signal Association (IMSA) certified Level I, or greater. An IMSA certified Level II technician shall be present on site during all cabinet terminations and during the installation of all signs, pavement markings, signals, pushbuttons, and traffic control.

3.05 SALVAGED MATERIALS

At existing traffic signal installations which are to be updated or modernized by the Contractor, all abandoned wire, cable, signals, poles, pole bases, pole tops, mast arms, signs and other miscellaneous equipment shall be taken down and/or removed. All equipment shall be reduced to simplest form. These salvaged materials are the property of the City of Schertz and are to be delivered and unloaded to the location or locations designated by the City of Schertz Traffic Signal Inspector assigned to the project.

3.06 ELECTRICAL SERVICE

The Contractor shall notify the City of Schertz Traffic Signal Inspector assigned to the project **within seven (7) days of Contractor award** for power at intersection.

Upon completion of the meter service, the Traffic Signal Inspector will conduct the meter service inspection. If installation is correct, he will forward the pertinent information to Traffic Signal Engineering and Operations (210-619-1800). The City of Schertz will contact the energy provider to have the service turned on.

3.07 SUBCONTRACTING

If a vendor subcontracts any portion of a contract for any reason, he must include, in writing, the name and address of the subcontractor, name of the person to be contacted including telephone number and extent of work to be performed. This information is to be submitted with bid proposal. In the event of a change during construction, Contractor is required to submit new information to the Engineer and/or the approved City of Schertz Representative, for approval, **five (5) days** prior to using the subcontractor on the job. City of Schertz reserves the right to reject a bid of any bidder if the bid names a subcontractor who has previously failed in the proper performance of an award or failed to deliver on time contracts of a similar nature, or who is not in a position to perform properly under this award. City of Schertz reserves the right to make determination as to the foregoing.

3.08 SYSTEM GROUNDING

All poles, cabinets, conduits, signal common, and service common shall be bonded with a No. 8 AWG bare copper wire, or equal, to form a continuous system and effectively grounded to 5/8-inch x 8 foot copperweld ground rods.

3.09 STRANDED GALVANIZED STEEL CABLE

Guy, messenger and catenary wires shall be Siemens Martin Grade, seven strand, galvanized, high strength steel cable, 5/16 inch diameter for guy and catenary wires and ¼ inch diameter for messenger wires.

3.10 POLE RAKING

Poles shall be set with a sufficient amount of rake so that they are plumb with the signal load or slightly raked away from the signal load. Cantilever pole structures and 4-1/2" OD steel poles should be plumb, strain poles should have a slight backward rake (1 to 2 inches); wood poles shall utilize down guys to maintain appropriate signal height clearance during construction. The Contractor shall rake the poles to the satisfaction of the Traffic Signal Inspector.

Rake is hereby defined as the inclination to the vertical measured at the top of the structure in the opposite direction of the strain axis.

3.11 ABANDONED FOUNDATIONS

The tops of unused foundations shall be removed to a depth of two feet (minimum) below grade and back-filled according to specifications.

3.12 LOADS AND STRESSES DUE TO CONSTRUCTION OPERATIONS

Contractor shall have full responsibility for preventing over-stresses of any structure, cables, poles or any part of them during construction. This also applies to existing work facilities affected by his operations. He shall fully check the effect of his operations in this regard, and shall provide temporary supports and connections required to assure safety and stability of both new and existing work to prevent over-stress of any part thereof.

3.13 APPARATUS LOCATION

The locations of all poles, controllers, actuators and signals shown on the plans are diagrammatic only. The specific locations of such devices shall be decided by the appropriate design personnel and shall be staked out under his direction. Vehicular and pedestrian traffic signals shall be placed and aligned as the City of Schertz Traffic Signal Inspector directs.

3.14 CONCRETE POUR

The time of day of the concrete pour shall be stipulated by the Contractor.

3.15 SEQUENCE OF WORK

Each new signalized intersection shall be in operable condition including electrical service within **fourteen (14) days** after the first signal pole is installed, unless

conditions caused by a paving contractor or roadway construction contractor prevents the completion of the intersection(s).

The order in which the intersections are to be completed may be specified by the Engineer and/or the approved City of Schertz Representative and it shall be the sole responsibility of the Contractor to schedule and coordinate his work, all work shall be coordinated in such a manner as to prevent delays resulting from work to be performed by others and to complete his work within the specified time.

On the day when the intersection is to be turned on or its "Turn On" date, the Contractor will be given a "punch list" from the Signal Inspector for any items that need attention concerning the conditions of signal equipment. These items shall be completed within **ten (10) days** of the date on the "punch list" given to the contractor.

3.16 UTILITY COORDINATION

The Contractor shall contact the Lone Star Notification Center 800-669-8344, **72 hours** before commencing any work to locate any utility lines in the construction area. It is the Contractor's responsibility to physically locate any water and sewer lines and to adjust the location of any foundation(s), for approval by the City of Schertz Traffic Signal Engineering and Operations.

3.17 UNDERGROUND UTILITIES

The exact location of underground utilities and pipelines is not certain. The Contractor shall contact the Utility Coordinating Committee (U.C.C.) to determine exact locations of underground utilities prior to drilling for foundations or any other work that might interfere with or damage present facilities. Contractor shall be responsible for keeping the transmittal number from the U.C.C. current during construction.

3.18 LOCAL CONDITIONS

The Contractor shall make any additional investigations he deems necessary to properly bid any and all work related thereto. No additional compensation will be made available to the Contractor for work arising from failure to examine the site and/or subsoil conditions. Staking of specific locations by the Engineer and/or the approved City of Schertz Representative shall not remove the Contractors responsibility for any damage caused by the Contractor to any underground utility.

3.19 RIGHTS OF VARIOUS INTERESTS

Wherever work being done by the City's forces or by any other Contractor is contiguous to work covered by this contract, the respective rights of the various interests involved shall be established by Engineer and/or the approved City of

Schertz Representative, to secure completion of the various portions of the work in general harmony.

3.20 TRENCHING

No trenching shall be allowed within five feet of a tree.

3.21 DIRECTIONAL DRILLING, BORE, AND JACK

No open cutting or trenching of streets, driveways and sidewalks shall be allowed without prior approval of the Engineer and/or the approved City of Schertz Representative at each location. All conduit runs under streets, driveways or sidewalks shall be by directional drilling, bore, or jack. Water jetting methods shall not be accepted.

3.22 PUBLIC SAFETY AND CONVENIENCE

All work done under this contract shall be done in compliance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Each operation shall be considered a work zone area and shall be treated in accordance with the TMUTCD.

The Contractor shall have a Certified Worksite Traffic Supervisor who will be responsible for initiating, installing, and maintaining all traffic control devices as described in the TMUTCD. The Worksite Traffic Supervisor shall have at least one (1) year of experience directly related to worksite traffic control in a supervisory or responsible capacity and shall be certified by the American Traffic Safety Services Association or International Municipal Signal Association. The Worksite Traffic Supervisor will be incidental to Maintenance of Traffic and will not be measured separately for payment.

The Worksite Traffic Supervisor shall be available on a **twenty-four (24) hour day** basis and shall review the project on a day to day basis as well as being involved in all changes to traffic control. The Worksite Traffic Supervisor shall have access to all equipment and materials needed to maintain traffic control and handle traffic related situations. The Worksite Traffic Supervisor shall insure that routine deficiencies are corrected with a **twenty-four (24) hour** period.

The Worksite Traffic Supervisor shall be available on the site within **forty-five (45) minutes** after notification of an emergency situation, prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangements.

Failure of the Worksite Traffic Supervisor to comply with these provisions may be grounds for decertification or removal from the project or both. Failure to maintain a designated Worksite Traffic Signal Supervisor or failure to comply with these

provisions will result in temporary suspension of all activities except traffic and such other activities deemed to be necessary for project maintenance and safety.

The Contractor shall at all times so conduct his work as to insure the least possible obstruction to normal pedestrian and vehicular traffic including access to all public and private properties during all stages of construction, and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property, in a manner satisfactory to the City Engineer and/or the approved City of Schertz Representative.

The Contractor shall provide all barricades and take all necessary precautions to protect buildings and personnel. All work shall be complete in every respect and accomplished in a workmanlike manner and contractor shall provide for removal of all debris from City of Schertz property.

The successful bidder shall at all time guard against damage or loss to the property of the City of Schertz or of other vendors or contractors and shall be held responsible for replacing or repairing any such loss or damage. Any damage to landscaping in the work area, including sod shall be replaced at the Contractor's expense.

Prior to closing any section of the project to traffic, the Contractor shall furnish, erect and maintain barricades and warning signs at and in the vicinity of all construction projects at all times, both day and night, during the construction period of the contract, and all such barricades and warning signs, shall be in conformance with the requirements of Part 6 Temporary Traffic Control of the Texas Manual on Uniform Traffic Control Devices and as shown on the drawings.

Unless otherwise set forth in these specifications, the Contractor shall receive no direct compensation for furnishing, erecting, and maintaining the necessary barricades, lights, flares, signs, or for any other incidentals necessary for the good and proper safety, convenience, and direction of traffic during the period prior to final inspection and acceptance by the City of Schertz.

3.23 SPECIAL REQUIREMENTS

A. A Steel Template shall be furnished by and used by the Contractor to secure anchor bolts while constructing pole foundations.

B. Pole Foundations shall be capped where needed, in order to provide a smooth, flat, and level surface. Capping shall consist of a one (1) inch thick mortar cap prepared with a 1:3 sand-cement mortar ratio. The cap shall be steel trowel finished.

C. Extra-length Concrete Pole Foundations shall be provided when required by site conditions. Reinforcing steel shall be increased by the same length as the increase in foundation length. Rods shown on Foundation Details shall be

increased as follows: Each extra foot of foundation shall require on additional foot of length for hooked rods and two additional turns for helix.

D. All Special Foundations shall be designated and approved by the appropriate design engineer and/or the approved City of Schertz Representative.

E. Sono Tube shall be used when the City of Schertz Traffic Signal Inspector deems it necessary.

3.24 CONCRETE FINISHING

Honeycombed surfaces or other defects shall be patched with mortar of the same consistency as the mortar from which the concrete is made. Such mortar shall be well trowelled and then floated to remove trowel marks.

A. Finish for Formed Surfaces After patching above specified, exposed formed surfaces shall be finished by removing form marks, fins and other projections.

B. Finish for Uniformed Surfaces
   1. Patches in streets, driveways and walks shall be finished to match adjacent surfaces.
   2. Surfaces not Otherwise Specified – Steel trowel finish.

3.25 CONCRETE CURING

Immediately after placing or finishing, concrete surfaces shall be protected against moisture loss for **a minimum of seven (7) days**. Wet earth, waterproof paper, vinyl sheets or cotton mats shall be placed over concrete during curing period in order to insure fulfillment of this requirement. Membrane curing method may be used **EXCEPT when** concrete surfaces are to receive additional concrete or mortar, or are to be painted.

3.26 CONCRETE/PAVEMENT REPAIR

Repairs to concrete pavement shall be in accordance with Public Works Drawing Numbers 02902-01and 02902-02 titled, “Pavement Repair Details for Street Cuts”.

3.27 FLEXIBLE BASE PAVEMENT REPAIR

Repairs to flexible base pavement shall be made in accordance with Public Works Drawing Number 02902-01 titled, “Pavement Repair Details for Street Cuts”.

3.28 TRAFFIC SIGNAL TESTING SERVICES

A. PROCEDURES

   1. Selection:

City of Schertz shall employ an Independent Testing Laboratory to ensure Contract Document compliance.

2. Test Reports
   Testing laboratory will furnish reports to the Engineer, Structural Engineer, City of Schertz and Contractor covering all of its determinations and all of its control services. Reports will show all data customarily listed by the laboratory in reporting such tests including daily reports on quantities and types of materials together with location in the project. Form of reports will be as approved by the Engineer and/or the approved City of Schertz Representative.

3. Test Methods
   Tests and inspections will be conducted in accordance with the requirements of these Specifications or, if not herein specified in accordance with the latest standards of the American Society for Testing and Materials or other recognized authorities.

4. Contractor's Responsibility

   (a) Cooperate with the testing laboratory and:

      (1) Make available, without cost, samples of all materials to be tested.

      (2) Furnish such normal labor as is necessary to obtain samples at the project and to assist in making slump tests and casting and curing cylinders.

      (3) Advise the laboratory of the identity of material sources and instruct these suppliers to allow inspections by the laboratory, and notify the laboratory sufficiently in advance of operations to allow for completion of initial tests and assignment of inspection personnel.

      (4) Contractor shall provide laboratory testing for each different concrete load.

   (b) Rejected Materials and/or Workmanship
      If, after initial tests have been performed, any materials and/or workmanship are rejected by the testing laboratory, Contractor shall
      (1) Pay for any subsequent testing required for materials which have been rejected and/or replaced.

      Any materials and/or workmanship which are rejected by the testing laboratory by reason of failure to conform to the requirements of the Drawings and/or Specifications, shall be removed and replaced with new acceptable materials by the Contractor at his own expense.

5. Additional Responsibility
   (a) The testing of all cable furnished shall be properly tested by the manufacturer and data submitted through the Contractor to the Engineer and/or the approved City of Schertz Representative.

   (b) All cable furnished to the job site shall be properly tested on the reel use.

3.29 PRELIMINARY WORK

A. PROCEDURES
1. City Requirements
   (a) City requirements relating to the work of this section shall be ascertained by the Contractor. Contractor shall comply with all such requirements, including those relating to continued maintenance until completion of the project.

      (1) If the City should require that certain portions of the work be performed by City personnel and equipment, all costs in connection therewith which are chargeable against the project shall be paid by the Contractor as an obligation of this Section

      (2) If re-routing of vehicular and/or pedestrian traffic is necessary to complete work of this Contract, Contractor shall submit a copy of his proposed re-routing plan to the City and the Engineer and/or the approved City of Schertz Representative for approval **seventy-two (72) hours** before proceeding with the work.

      (3) Re-installation and restoration of use of existing public and private installations, which are temporarily and/or permanently removed and/or relocated for work of this Contract, shall be performed as a part of the work of this Section

2. Existing Installations of City-Owned Property
   (b) Perform all work relative to removal, storage and/or protection of existing installations of street lights and signs, fire hydrants, manholes, and other existing installations in the way of project construction.

   (c) Provide and maintain approved temporary protection of existing installations until project completion and acceptance. Remove temporary protection when, and as, directed by the City.

   (d) Existing facilities which are no longer required shall be disconnected as directed. Comply with the requirements of municipal agencies having jurisdiction over such work.

(e) Unless otherwise directed, all abandoned facilities shall be removed by Contractor and the holes and trenches filled with approved compacted fill.

3.30 GUARANTEES

All items installed under this specification, having a manufacturer's guarantee shall be installed by or under the direction of the manufacturer or his certified agent, when so required to conform with the manufacturer's guarantee, and all such manufacturer's guarantees, warranties and bonds shall be forwarded to the City of Schertz representative.

The Contractor, by accepting this contract, guarantees all workmanship, materials and equipment performed or furnished and installed under this specification for a period of one year from date of completion and shall, at his entire expense and within said term of guarantee, repair, replace or adjust all faulty, broken, or maladjusted materials and/or equipment furnished and installed under this specification, including lamp replacement.

END OF SECTION

SECTION 02911

TOPSOIL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for topsoil under this Section. Include payment in Section 02921 - Hydro-mulch Seeding or Section 02922 - Sodding.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having following characteristics:

1. pH value of between 5.5 and 6.5

2. Liquid limit: 50 or less

3. Plasticity index: 20 or less

4. Gradation: maximum of 10 percent passing No. 200 sieve

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2-In.

C . Obtain topsoil from naturally well-drained areas where topsoil occurs at minimum depth of 4-In. and has similar characteristics to that found at

placement site. Do not obtain topsoil from areas infected with growth of, or reproductive parts of nut grass or other noxious weeds.

PART 3 EXECUTION

3.01 EXAMINATION

A. Excavate topsoil for esplanades and areas to receive grass or landscaping from areas to be further excavated. Stockpile in area approved by Public Works.

B. Stockpile topsoil to depth not exceeding 8-Ft. Cover to protect from erosion.

3.02 TOPSOIL EXCAVATION

A. Conform to excavation and stockpiling requirements of Section 02315 – Roadway Excavation.

3.03 PLACEMENT

A. Place no topsoil until subgrade has been approved. For areas to be seeded or sodded, scarify or plow existing material to minimum depth of 4-In., or as indicated on Drawings. Remove vegetation and foreign inorganic material. Place 4-In. of topsoil on loosened material and roll lightly with appropriate lawn roller to consolidate topsoil.

B. Increase depth of topsoil to 6-In. when placed over sand bedding and backfill materials specified in Section 02320 - Utility Backfill Material.

C. For areas to receive shrubs or trees, excavate existing material and place topsoil to depth and dimensions shown on Drawings.

D. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of Section 01576 - Waste Material Disposal.

E. Place topsoil to promote good drainage and compact with light roller. Water topsoil after placement until saturated for minimum depth 6-In., fill in and recompact areas of settlement.

3.04 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

SECTION 02915

TREE PLANTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Street right-of-way tree planting and maintenance.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for tree planting is on unit price basis for each tree planted.

2. When shown on Drawings or directed by Public Works to remove and relocate tree affected by trench zone, work shall be paid for under one of the following bid items.

a. Bid item "Remove and Relocate Tree" includes moving tree with truck mounted tree spade and replanting same tree in new location. Payment is for each tree removed and relocated.

b. Bid item "Remove, Temporary Store and Replant Tree" includes moving tree with truck mounted tree spade and replanting tree at temporary location, (determined by Contractor) maintaining tree until construction is complete and replanting same tree back to its original location. Payment is for each tree removed, stored and replanted.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI Z 60.1 - Nursery Stock.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification from supplier that each type of tree conforms to these specification requirements.

C. For unpackaged materials, submit analysis by recognized laboratory made in accordance with methods established by Association of Official Agriculture Chemists, when applicable.

D. Submit name and experience of qualified Arborist to Public Works.

E. Submit temporary tree storage location. Location must be outside public right-of-way and within 5 miles of project site, unless otherwise approved by Public Works.

1.05 QUALITY ASSURANCE

A. Landscaper shall be a firm specializing in landscape and planting work.

B. Do not make substitutions of approved trees unless approved in writing by Public Works. When specified planting material is not obtainable, submit proof of non-availability together with proposal for use of equivalent material. Substitutions of larger size or better grade than specified will be allowed, but with no increase in unit price.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ship trees with Certificates of Inspection as required by governing authorities. Label each tree and shrub with securely attached waterproof tag bearing legible designation of botanical and common name. Do not remove container grown stock from containers before time of planting.

B. Deliver packaged materials in fully labeled original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at Site.

C. Materials shall not be pruned prior to installation unless approved by Public Works in writing. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches, or destroy natural shape. Use protective covering during delivery.

1.07 WARRANTY

A. Warrant trees against defects including death, unsatisfactory growth, or loss of shape due to improper pruning, maintenance, or weather conditions, for 1 year after completion of planting. Plumb leaning trees during warranty period.

B. Remove and replace trees found to be dead during warranty period. Remove and replace trees which are in doubtful condition at end of warranty period, or when approved by Public Works, extend warranty period for trees for full growing season.

PART 2 PRODUCTS

2.01 TREES

A. Trees planted shall be a minimum of two and one-half inches (2.5”) caliper measured at four feet (4’) above ground level at the time of planting.

B. Trees shall conform to following requirements:

1. Healthy, vigorous stock, grown in recognized nursery.

2. Free of disease, insects, eggs, larvae; and free of defects such as knots, sun-scald, injuries, abrasions, disfigurement, or borers and infestations.

C. Trees shall conform to current UDC list of approved trees, Table 21.9.7A “Approved Shade Trees”, or Table 21.9.7B, “Approved Ornamental, Evergreen, and Palm Trees.”

2.02 SOIL PRODUCTS

A. Topsoil: Conform to requirements of Section 02911 - Topsoil.

B. Peat moss, bark, and fertilizer: Use material recommended by nursery for establishment of healthy stock after replanting.

2.03 STAKES AND GUYS

A. Provide minimum 8-Ft. long steel T-stakes and 1-In. wide plastic tree chains.

B. Where applicable for anchoring trees, use wood deadmen of at least 2 by 4 stock, 36-In. long and buried 3-Ft. Provide white surveyor's plastic tape for flagging tree guys.

2.04 TREE WRAP, TWINE, AND SEAL

A. Wrap: First quality, bituminous impregnated tape, corrugated or crepe paper, specifically manufactured for tree wrapping and having qualities to resist insect infestation.

B. Twine: Lightly tarred, medium-coarse sisal (lath) yarn. Do not use nails or staples to fasten wrapping.

C. Seal: Commercially available asphaltic-base black emulsion specifically produced for use in sealing tree cuts and wounds.

2.05 WATER

A. Water shall be potable from municipal water supplies.

2.06 SOURCE QUALITY CONTROL

A. Notify Public Works, prior to installation, of location where trees that have been selected for planting may be inspected. Plant material will be inspected for compliance with following requirements.

1. Genus, species, variety, size and quality.

2. Size and condition of balls and root systems, insects, injuries and latent defects.

PART 3 EXECUTION

3.01 PREPARATION

A. Schedule work so that planting can proceed rapidly as portions of site become available. Plant trees after final grades are established and prior to planting of lawns, unless otherwise approved by Public Works in writing. When planting of trees occurs after seeding work, protect lawn areas and promptly repair damage to lawns resulting from tree planting operations.

B. Layout individual trees at locations shown on Drawings. In case of conflicts, notify Public Works before proceeding with work. Trees shall be staked and approved by Public Works prior to planting.

3.02 PREPARATION OF PLANTING SOIL

A. Before mixing, clean topsoil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

B. Strip and utilize 4-In. layer of top soil, placed on esplanades under Section 02921 - Hydromulch Seeding, for planting soil mixture.

C. Mix recommended soil amendments with topsoil at following rates:

1. Top soil: 50 percent.

2. Peat moss: 25 percent.

3. Well rotted Bark: 25 percent.

4. Fertilizer: Rate recommended by nursery.

D. Delay mixing of fertilizer when planting will not follow placing of planting soil within 48 hours, unless otherwise directed.

E. Incorporate amendments into soil as part of soil preparation process prior to fine grading, fertilizing, and planting. Broadcast or spread amendments evenly at specified rate over planting area. Thoroughly incorporate amendments into top 3 or 4-In. of soil until amendments are pulverized and have become homogeneous layer of topsoil ready for planting.

3.03 PLANTING

A. Excavate pits, beds, or trenches with vertical sides and with bottom of excavation raised minimum of 6-In. at center for proper drainage. Provide following minimum widths:

1. 15 gallon containers or larger, 2-Ft. wider than diameter of root ball.

2. 1 and 5 gallon containers, 6-In. wider than diameter of root ball.

B. When conditions detrimental to plant growth are encountered, such as unsatisfactory soil, obstructions, or adverse drainage conditions, notify Public Works before planting.

C. Deliver trees after preparations for planting have been completed and plant immediately. When planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap, or other acceptable means of retaining moisture, and water as needed.

D. Set root ball on undisturbed soil in center of pit or trench and plumb plant. Place plants at level that, after settlement, natural relationship of plant crown with ground surface will be established.

E. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

F. Dish top of backfill to allow for mulching. Mulch pits, trenches and planted areas. Provide not less than 4-In. thickness of mulch, work into top of

backfill, and finish level with adjacent finish grades. Cover entire root ball.

G. Prune, thin out and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed in writing, do not cut tree leaders, and remove only injured and dead branches from flowering trees. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

H. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures.

I. Guy and stake trees immediately after planting.

J. Control dust caused by planting operations. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.

3.04 FIELD QUALITY CONTROL

A. Public Works may reject unsatisfactory or defective material at anytime during progress of work. Remove rejected trees immediately from site and replace with specified materials. Plant material not installed in accordance with these Specifications will be rejected.

B. An inspection to determine final acceptance will be conducted by Public Works at end of 12 month maintenance period. Additional inspections will be conducted for extended warranty periods provided for in paragraph 1.07B.

3.05 MOVING EXISTING TREES

A. Perform tree moving and replanting by a professional Arborist during dormant growth season.

B. Provide tree spade of adequate size as directed by professional Arborist.

3.06 MAINTENANCE

A. Maintain trees during planting operations and for period of 12 months after completion of planting.

B. Water trees to full depth minimum of once each week, or as required to maintain healthy vigorous growth.

C. Prune, cultivate, and weed as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports, and reset trees and shrubs to proper grades or vertical position as required. Restore or replace

damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease

3.07 CLEANUP AND PROTECTION

A. During planting work, keep pavements clean and work area in orderly condition.

B. Protect planting work and materials from damage due to planting operations. Maintain protection during installation and maintenance period. Treat, repair, or replace damaged planting work as directed by Public Works.

C. Dispose of excess soil and waste in accordance with requirements of Section Waste 01576 - Waste Material Disposal. On-site burning of combustible cleared materials will not be permitted.

END OF SECTION

SECTION 02921

HYDROMULCH SEEDING

PART 1. GENERAL

1.01 SECTION INCLUDES

A. Spray-applied Wood fiber for [hydro mulching.], fertilizing, and maintenance of areas indicated on Drawings

1.02 MEASUREMENT AND PAYEMENT

A. Unit Prices

1. Payment for hydro mulch seeding is per acre.

2. Refer to Section 01270 – Measurement and Payments for unit price procedures

B. Stipulated Price (Lump sum) If Contract is Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.03 REFERENCES

1. Section 01570 – Storm Water Pollution Control.

2. Section 01740 – Site Restoration

3. Section 02911 – Top Soil

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials, and application rate.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures, and construction operations.

PART 2. PRODUCTS

2.01 MATERIALS

A. Seeds

1. All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing purity, germination, name and type of seed. Seed furnished shall be of the previous season's crop for the date of the project.

2. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety shall be furnished for analysis and testing when directed by the Engineer.

3. The amount of seed planted per acre shall be of the type specified below and shall equal or exceed the following percentages for purity and germination or an equivalent amount of pure live seed.

   a. Common Name: Bermuda and Giant Bermuda grass (hulled)

   b. Scientific Name: Cynodon Dactylon

   c. Purity: 95%

   d. Germination: 90%

   e. Annual Rye grass will be free of Johnson grass, field bind weed, dodder seed, and free of other seed to the limits allowable under the Federal Seed Act and applicable State Seed Laws.

   f. Annual Rye grass will be added into slurry between October 1 through March 15. No additional cost will be charged to the City.

B. Wood Fiber Mulch: Terra-Mulch Wood fiber with UltraGro by PROFILE Products LLC with the following characteristics:

1. Materials: 100% wood fiber, dark green marker dye.

2. UltraGro Biostimulant: Trace amount of cold water processed Ascophyllum Nodosum (seaweed extract).

3. pH Range: 4.8 +-2.

4. Moisture Content: 12+-3% percent maximum.

5. Organic Content: 99.2%+-.4.

6. Ash Content: .8%+-.4.

7. Water Holding Capacity: 1200% percent minimum.

8. Packaging: 40 pound UV resistant bags, with UV resistant pallet cover.

C. Unacceptable Material is paper/cellulose mulch

PART 3. EXECUTION

3.01 SUBSTRATE PREPARATION

A. Examine substrates and conditions where materials will be applied. Do not proceed with installation until unsatisfactory conditions are corrected, only apply product to geotechnically stable slopes that have been designed and built to divert the water shed away from the face of the slope, therefore eliminating surface flow energy from above from damaging the slope face.

3.02 INSTALLATION

A. Strictly comply with manufacturer's installation instructions and recommendations. Use approved hydro-spraying machines. Do not exceed maximum slope length of 25 feet when slope gradients are steeper than 4 to 1. Install materials at the following application rate:

1. Hydro-Seeding: Add 30 to 50 pounds of Terra-Mulch Wood fiber per 100 gallons of water when hydroseeding; confirm loading rates with equipment manufacturer.

a. Mod to 4 to 1 Slope: 1500 pounds per acre.

b. 3 to 1 Slope: 2000 pounds per acre.

c. 3:1 to 2:1 Slope: 2500 pounds per acre.

3.03 CLEANING AND PROTECTION

A. Clean spills promptly. Advise Owner of methods for protection of sprayed areas.

3.04 ACCEPTANCE

A. Acceptance of hydromulching lawn as herein specified shall be based on a uniform stand of grass and a uniform grade at the time of final inspection. Area of two square feet or more that are bare or have a poor stand of grass and area not having a uniform grade for any cause before final inspection shall be regraded, rehydromulched and reseeded as specified at the Contractor's expense

END OF SECTION

SECTION 02922

SODDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Restoration of existing lawn areas disturbed by construction shall be by installation of new sod.

B. Planting of sod within areas designated on Drawings for purpose of surface stabilization, channel stabilization or vegetation buffer strips.

C. Sod is defined as blocks, squares, strips of turfgrass, and adhering soil used for vegetative planting. To be placed edge to edge for complete coverage.

D. Lawn is defined as ground covered with fine textured grass kept neatly mowed.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for sodding is on square yard basis.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

1.04 QUALITY ASSURANCE

A. Sod only when weather and soil conditions are deemed by Public Works to be suitable for proper placement.

B Water and fertilize new sod.

C. Guarantee sod to be growing 30 days after substantial completion.

D. Maintenance Period:

1. Begin maintenance immediately after each section of grass sod is installed and continue for 30 day period from date of substantial completion.

2. Resod unacceptable areas.

3. Water, fertilize, control disease and insect pests, mow, edge, replace unacceptable materials, and perform other procedures consistent with good horticultural practice to ensure normal, vigorous and healthy growth. Install disease control within guidelines set forth by Structural Pest Control Board of the State of Texas.

E. Notify Public Works 10 days before end of maintenance period for inspection.

PART 2 PRODUCTS

2.01 SOD

A. Species: Bermuda (Cynodon Dactylon), Buffalo (Buchloe Dactyloides), or St. Augustine (Stenotaphrum Secundatum) Gulf Coast variety to match existing sod.

B. Contents: 95 percent permanent grass suitable to climate in which it is to be placed; not more than 5 percent weeds and undesirable grasses; good texture, free from obnoxious grasses, roots, stones and foreign materials.

C. Size: 12-In. wide strips, uniformly 2-In. thick with clean-cut edges.

D. Sod is to be supplied and maintained in healthy condition as evidenced by grass being normal green color.

2.02 FERTILIZER

A. Available nutrient percentage by weight: 12 percent nitrogen, 4 percent phosphoric acid, and 8 percent potash; or 15 percent nitrogen, 5 percent phosphoric acid, and 10 percent potash.

2.03 WEED AND INSECT TREATMENT

A. Provide acceptable treatment to protect sod from weed and insect infestation. Submit treatment method to Public Works for approval. Install insect and disease control within guidelines set forth by Structural Pest

Control Board of the State of Texas.

2.04 WATER

A. Potable, available on-site through Contractor's water trucks. Contractor may use City of Schertz hydrants when water use is measured through Contractor's meter. Do not use private resident's water.

2.05 BANK SAND

A. Free of clay lumps, roots, grass, salt or other foreign material.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that soil placement and compaction have been satisfactorily completed. Verify that soil is within allowable range of moisture content.

B. Top soil shall be free of weeds and foreign material immediately before sodding.

C. Do not start work until conditions are satisfactory. Do not start work during inclement or impending inclement weather.

D. Rake areas to be sodded smooth, free from unsightly variations, bumps, ridges or depressions.

E. Spread 2-In. layer of bank sand over areas to be sodded prior to planting of sod.

F. Apply fertilizer at rate of 25 pounds per 1000 square feet. Apply after raking soil surface and not more than 48 hours prior to laying sod. Mix thoroughly into upper 2-In. of soil. Lightly water to aid in dissipation of fertilizer.

3.02 APPLICATION

A. Full Sodding: Lay sod with closely fitted joints leaving no voids and with ends of sod strips staggered. Lay sod within 24 hours of harvesting.

B. On slopes 2:1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2-Ft. on center. Drive pegs flush with soil portion of sod.

C. Prior to placing sod, on slopes 3:1 or where indicated, place Hold/Gro or Roll Lite or equal over topsoil. Securely anchor in place with posts sunk firmly into ground at maximum 16-Ft. on center along pitch of slope and

equal to width of wire mesh horizontally across slopes.

D. After sod is laid, irrigate thoroughly to secure 6-In. minimum penetration into soil below sod.

E. Tamp and roll sod with approved equipment to eliminate minor irregularities and to form close contact with soil bed immediately after planting and watering. Submit type of tamping and rolling equipment to be used to Public Works for approval, prior to construction.

3.03 MAINTENANCE

A. Watering:

1. Water lawn areas once a day with minimum ½-In. water for first 3 weeks after area is sodded.

2. After 3 week period, water twice a week with ¾-In. of water each time unless comparable amount has been provided by rain.

3. Make weekly inspections to determine moisture content of soil unless soil is in frozen condition.

4. Water in afternoon or at night to enable soil to absorb maximum amount of water with minimum evaporation.

B. Mowing:

1. Mow sod at intervals which will keep grass height from exceeding 3 ½-In.

2. Set mower blades at 2 ½-In.

3. Do not remove more than one-half of grass leaf surface.

4. Mow sodded areas requiring mowing within 1 month after installation with light-weight rotary type mower. Mow sod only when dry and not in saturated or soft condition.

5. Remove grass clippings during or immediately after mowing.

C. Fertilizer and Pest Control:

1. Evenly spread fertilizer composite at rate of 40 pounds per 5000 square feet or as recommended by manufacturer. Do not place

fertilizer until 2 weeks after placement of sod.

2. Restore bare or thin areas by topdressing with mix of 50 percent sharp sand and 50 percent sphagnum peat moss.

3. Apply mixture 1/4 to ½-In. thick.

4. Treat areas of heavy weed and insect infestation as recommended by treatment manufacturer.

D. Restrict all traffic from sodded areas until sod is established or for minimum 10 days during growing season. Use wood lath and plastic tape to cordon sodded areas. Maintain tape and lath throughout for minimum 30 days during growing season.

3.04 MAINTENANCE

A During the lawn establishment period, it shall be the contractor's responsibility to ensure the continuing healthy growth. This care shall include labor, water and material necessary to keep the project in a presentable condition, including but not limit to removal of litter, mowing, trimming, removal of grass clippings, edging, fertilization, insecticide and fungicide applications, weed control, and repair and reseeding any and all damaged areas.

B Water application shall be accomplished each week from March through October. An even application of one inch minimum of water shall be required over all lawn areas weekly. The rate and frequency of water application may be changed, as directed by the Public Works, depending on weather, and soil conditions.

3.05 CLEANUP

A. During course of planting, remove excess and waste materials; keep lawn areas clean and take precautions to avoid damage to existing structures, plants, grass, and streets.

B. Remove barriers, signs, and other Contractor material and equipment from project site at termination of establishment period.

C. Dispose of unused materials and rubbish in accordance with Section 01576 Waste Material Disposal.

END OF SECTION

SECTION 02925

FLEXIBLE GROWTH MEDIUM

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies a hydraulically-applied Flexible Growth Medium (FGM) composed of long strand, thermally refined wood fibers, crimped, interlocking fibers and performance enhancing additives. The FGM requires no curing period and upon application forms an intimate bond with the soil surface to create a continuous, porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for Flexible Growth Medium is on an square yard or acres basis

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total stipulated price.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials, and application rate.

B. Certifications: Manufacturer shall submit a letter of certification that the products meets or exceeds all physical property, endurance, performance and packaging requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

Deliver materials and products in UV and weather resistant factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures, and construction operations.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

PROFILE Products LLC, 750 Lake Cook Road – Suite 440, Buffalo Grove, IL 60089,
Phone - 800-366-1180, Fax - 847-215-0577, website – www.profileproducts.com.

2.02 MATERIALS

Flexible Growth Medium shall be Flexterra® FGM and conform to the following property values when uniformly applied at a rate of 3500 pounds per acre (3900 kilograms/hectare) under laboratory conditions.

PHYSICAL	TEST METHOD[1]	ENGLISH	SI
Mass Per Unit Area	ASTM D6566	11.5 oz/yd^2	390 g/m^2
Thickness	ASTM D6525	0.19 in	4.8 mm
% Ground Cover	ASTM D6567	99%	99%
Water Holding Capacity	Profile Products[2]	1500%	1500%
Flexural Rigidity (wet)	ASTM D6575	0.138 oz-in	10,000 mg-cm
Cure Time	Observed	< 2 hr	< 2 hr
Color (fugitive dye)	Observed	Green	Green
Endurance			
Functional Longevity	Observed	Up to 1 yr	Up to 1 yr
Performance			
Cover Factor[3] (6 in/hr event)	ECTC Test Method #2	0.0066	0.0066
% Effectiveness[4]	ECTC Test Method #2	99.34%	99.34%
Shear Stress	ECTC Test Method #3	1 lb/ft^2	48 Pa
Vegetation Establishment	ECTC Test Method #4	800%	800%

1. ASTM and ECTC (Erosion Control Technology Council) test methods developed for Rolled Erosion Control Products.
2. Water Holding Capacity test developed by Profile Products LLC.
3. Cover Factor is calculated as soil loss ratio of treated surface versus an untreated control surface.
4. % Effectiveness = One minus Cover Factor multiplied by 100%.

2.03 COMPOSITION

All components of the FGM shall be pre-packaged by the Manufacturer to assure material performance and in compliance with the following values. **Under no circumstances will field mixing of additives or components be accepted.**

Thermally Processed Wood Fibers – 74.5% $\pm$ 3.5%
Proprietary Crosslinked Hydro-Colloid Tackifiers and Activators – 10% $\pm$ 1%
Proprietary Crimped, Interlocking Fibers – 5% $\pm$1%
Moisture Content – 10.5% $\pm$ 1.5%

2.04 PACKAGING

Bags: Net Weight - 50 lb, UV and weather-resistant plastic film
Pallets: Weather-proof, stretch-wrapped with UV resistant pallet cover
40 bags/pallet or 1 ton/pallet

PART 3 EXECUTION

3.01 SUBSTRATE AND SEEDBED PREPARATION

A. Examine substrates and conditions where materials will be applied. Apply product to geotechnically stable slopes that have been designed and constructed to divert runoff away from the face of the slope. Do not proceed with installation until satisfactory conditions are established.

B. Depending upon project sequencing and intended application, prepare seedbed in compliance with Section 02911 – Topsoil.

3.02 INSTALLATION

A. Strictly comply with manufacturer's installation instructions and recommendations. For optimum pumping and application performance use approved mechanically agitated, hydraulic seeding/mulching machines with a fan-type nozzle (50-degree tip). Apply FGM from opposing directions and to achieve best soil coverage.

B. Erosion Control and Revegetation:

For maximum performance, apply FGM in a two-step process:

Step One: Mix and apply seed and soil amendments with small amount of FGM for visual metering.

Step Two: Mix and apply FGM at a rate of 50 lb per 125 gallons (23 kg/475 liters) of water over freshly seeded surfaces. Confirm loading rates with equipment manufacturer. Do not leave seeded surfaces unprotected, especially if precipitation is imminent.

Depending upon site conditions FGM may be applied in a one-step process where all components may be mixed together in single tank loads. Consult with manufacturer for further details.

C. Mixing:

A mechanically agitated hydraulic-application machine is recommended:

1. Fill tank to middle of agitator shaft or tank about 1/3 full of water. Turn on pump to wet or purge lines. Begin agitating. Keep adding water slowly while adding the FGM at a steady rate.

2. Consult application and loading charts to determine number of bags to be added. Mix at a rate of 50 lbs. of FGM per 125 gallons (23kg/475 liters). Contact equipment manufacturer to confirm optimum FGM mixing rates.

3. All FGM should be loaded when the tank is approximately 3/4 full.

4. Fertilizer should be added once the tank is nearly full.

5. Before applying, mix the slurry for at least 10 minutes after adding the last amount of FGM. This is very important to fully activate the bonding additives and to attain proper viscosity.

6. Turn off recirculation valve to minimize potential for air entrainment within the slurry.

D. Application:

Use a fan-type nozzle (50-degree tip) whenever possible for best soil surface coverage. Apply FGM from opposing directions to soil surface, reducing the "shadow effect" and assuring a minimum of 95% of soil surface coverage. Slope interruption devices or water diversion techniques are recommended when slope lengths exceed 100 ft (30m). Install materials at the following minimum application rates:

Slope Gradient/Condition	English	SI
≤3H to 1V	3000 lb/ac	3400 kg/ha
>3H to 1V and ≤2H to 1V	3500 lb/ac	3900 kg/ha
>2H to 1V and ≤1H to 1V	4000 lb/ac	4500 kg/ha
>1H to 1V	4500 lb/ac	5100 kg/ha
Below ECB or TRM	1500 lb/ac	1700 kg/ha
As infill for TRM	3500 lb/ac	3900 kg/ha

Increase application rates on highly erosive soils or chiseled, disked, furrowed or tracked slopes.

Contact Manufacturer for additional details.

Material should not be applied in channels, swales or other areas where concentrated flows are anticipated, unless installed in conjunction with a temporary erosion control blanket or non-degradable turf reinforcement mat.

After application, thoroughly flush the tank, pumps and hoses to remove all FGM material. Wash all material from the exterior of the machine and remove any slurry

spills. FGM will be more difficult to remove once it dries.

3.03 CLEANING AND PROTECTION

Clean spills promptly. Advise Owner of methods for protection of treated areas. Do not allow treated areas to be trafficked or subjected to grazing.

END OF SECTION

SECTION 02926

EROSION CONTROL MATTING

PART 1. GENERAL

1.01 DESCRIPTION

A. An erosion control mat is a degradable erosion control blanket (ECB) designed to hold seed and soil in place until vegetation is established in disturbed areas or is a synthetic turf reinforcement mat (TRM or HPTRM) combining vegetative growth and synthetic materials to form a high-strength mat that helps prevent soil erosion in channels and on steep slopes.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for erosion control matting will be made by the square yard of surface area covered, complete in place and ready for use as an erosion control surface treatment.(Erosion Control Matting necessary for anchorage trenches, overlaps and waste is subsidiary to the design surface area.)

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. The submittal requirements for this specification item shall include the erosion control matting type and sample.

B. One (1) full set of Manufacturer’s literature and installation recommendations, and any special details necessary for the proposed application.

C. Certifications: Manufacturer shall submit a letter of certification that the products meets or exceeds all physical property, endurance, performance and packaging requirements as laid out by this specification.

D. Conform to requirements of Section 01330 - Submittal Procedures.

PART 2. MATERIALS

2.01 EROSION CONTROL BLANKETS (ECBs) - TEMPORARY

A. Straw Blanket ECB - shall consist of 100% wheat straw or excelsior mechanically bound and covered with degradable double netting. The straw or excelsior shall be homogeneously blended and evenly distributed throughout the blanket. The netting shall be rapid degrading polypropylene (< 90 days) or photodegradable polypropylene (> 90 days < 1 year) with mesh openings of approximately 3/8 in. by 3/8 in. (11 mm by 11 mm). The blanket shall be sewn on approximately 2 in. (51mm) centers with degradable polypropylene thread. For applications see Tables 2and 4.

B. Mix Media ECB shall consist of 70% wheat straw and 30% coconut fiber or 100% excelsior mechanically bound and covered on both sides by netting. The straw and coconut fiber or excelsior shall be homogeneously blended and evenly distributed throughout the blanket. The bottom netting shall be photodegradable polypropylene with mesh openings of approximately 3/8 in. by 3/8 in. (11 mm by 11 mm). The top netting shall be photodegradable polypropylene with mesh openings of approximately 5/8 in. x 5/8 in. (16 mm by 16 mm). The blanket shall be sewn on approximately 2 in. (51 mm) centers with degradable polypropylene thread. For applications see Tables 2and 4.

C. Coconut Fiber ECB -shall consist of 100% coconut fiber or excelsior mechanically bound and covered on both sides by netting. The coconut/ excelsior fiber shall be homogeneously blended and evenly distributed throughout the blanket. Both the top and bottom nettings shall be photodegradable polypropylene with mesh openings of approximately 5/8 in. by 5/8 in. (16 mm by 16 mm). The blanket shall be sewn on approximately 2 in. (51 mm) centers with degradable polypropylene thread. For applications see Tables 2and 4.

D. Products in each category shall have the following Minimum Average Roll Values (MARV) for physical properties, as derived from quality control testing performed by a Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) accredited laboratory. Letters of certification signed by a responsible representative of the manufacturer shall be sent within 24 hours of each truckload shipment of material to the construction site.

Table 1 Erosion Control Blanket Properties

	Property	Test Method	Straw Blanket ECB	Mix Media ECB	Coconut Fiber ECB
Physical	Mass/Unit Area	ASTM D5261	8.0 oz/yd^2 (271 g/m^2)	8.8 oz/yd^2 (298 g/m^2)	8.8 oz/yd^2 (298 g/m^2)
	Thickness	ASTM D1777	0.25 in (6 mm)	0.40 in (10.16 mm)	0.30 in (7.62 mm)
	Fiber Composition	Observed	Wheat straw/ excelsior	70% wheat straw / 30% coconut or 100% excelsior	Coconut or 100% excelsior
Mechanical	Grab Tensile Strength	ASTM D5035	75 x 75 lb/ft (1 x 1 kN/m)	100 x 100 lb/ft (1.46 x 1.46 kN/m)	150 x 150 lb/ft (2.19 x 2.19 kN/m)
	Grab Elongation	ASTM D5035	25%	30%	25%
	Vegetated Velocity[2]	---	$\leq$ 5 ft/sec (1.5 m/sec)	$\leq$ 5 ft/sec (1.5 m/sec)	$\leq$ 5 ft/sec (1.5 m/sec)
Performance	Unvegetated Shear Stress[3]	---	1.5 lb/ft^2 (72 N/m^2)	1.75 lb/ft^2 (84 N/m^2)	2.0 lb/ft^2 (96 N/m^2)
Endurance	Functional Longevity	Observed	$\leq$ 12 months	$\leq$ 24 months	$\leq$ 36 months

Note**:**

1. Above table represents typical values. A typical value is the average value obtained when testing the product
2. Maximum permissible design values based on short-term peak flow duration (0.5 hr), vegetated data obtained at Department-approved independent hydraulics testing facility on an erodible soil bed.
3. Maximum permissible design values based on short-term peak flow duration (0.5 hr), unvegetated data obtained at Department-approved independent hydraulics testing facility on an erodible soil bed.

Shear (kN/m^3) = unit weight of water (9.81 kN/m^3) x depth (m) x slope (m/m) in a “hydraulically wide” channel.

Shear (lb/ft^2) = unit weight of water (62.4 lbs/ft^3) x depth (ft) x slope (ft/ft) in a “hydraulically wide” channel.

Table 2 ECB and TRM Selection Guide for Slope Applications

	Slope Batter			
Functional Longevity (months)	**5.0H:1V**	**4.0H:1V**	**3.0H:1V**	**2.0H:1V**
3 – 12	Staw Blanket ECB			
12 – 24	Mix Media ECB			
24 – 36	Coconut Fiber ECB			
> 36	Turf Reinforcement Mats (TRM or HPTRM)			

Note:
1. For critical structures and/or 2:1(H:V) slopes a HPTRM should be considered.
2. For design purposes only. For slopes steeper than 2:1, please consult with Public Works for approval.

2.02 TURF REINFORCEMENT MATS (TRMs) – PERMANENT

A. The contractor shall submit, as a requirement of an acceptable bid, the name and manufacturer of the TRM and/or HPTRM on the bid form of this project.

B. Turf Reinforcement Mat (TRM) – shall be constructed of a web of mechanically or melt bonded polymer netting, monofilaments or fibers that are entangled to form a strong and dimensionally stable mat. Bonding methods include polymer welding, thermal or polymer fusion or the placement of fibers between two high-strength, biaxially oriented nets mechanically bound by parallel stitching with polyolefin thread. TRM shall be defined as Long-Term Non-Degradable material designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation for a period of time exceeding 5 years. All components of TRM shall be 100% synthetic and resistant to biological, chemical, ultraviolet degradation, and be tan or green in color. For applications see Tables 2and 4.

C. High Performance Turf Reinforcement Mat (HPTRM)– shall be a three-dimensional, lofty geosynthetic specially designed for erosion control applications on steepened slopes and vegetated waterways. The matrix shall be composed of tan or green, monofilament yarns woven into a uniform configuration of resilient pyramid-like projections or entangled with a high tenacity geogrid or steel wire mesh. The matrix shall exhibit very high interlock and reinforcement capacity with both soil and root systems and demonstrate high tensile modulus. TRM's manufactured from

discontinuous or loosely held together by stitched or glued, netting, or composite of any type, shall not be allowed in this category. HPTRM shall be defined as a High Survivability Long-Term Non-Degradable material designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation for a period of time exceeding 5 years. All components of HPTRM shall be 100% synthetic and resistant to biological, chemical, ultraviolet degradation. This category should be used especially when field conditions exist with high loading and/or high survivability requirements. These requirements consist of maintenance, structural backfills protecting critical structures, utility cuts, potential traffic areas, abrasion, and higher factors of safety and/or general durability concerns. For applications see Tables 2 and 4.

D. These materials shall conform to the Minimum Average Roll Values (MARV), listed in Table 3, for physical properties, as derived from quality control testing performed by a Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) accredited laboratory:

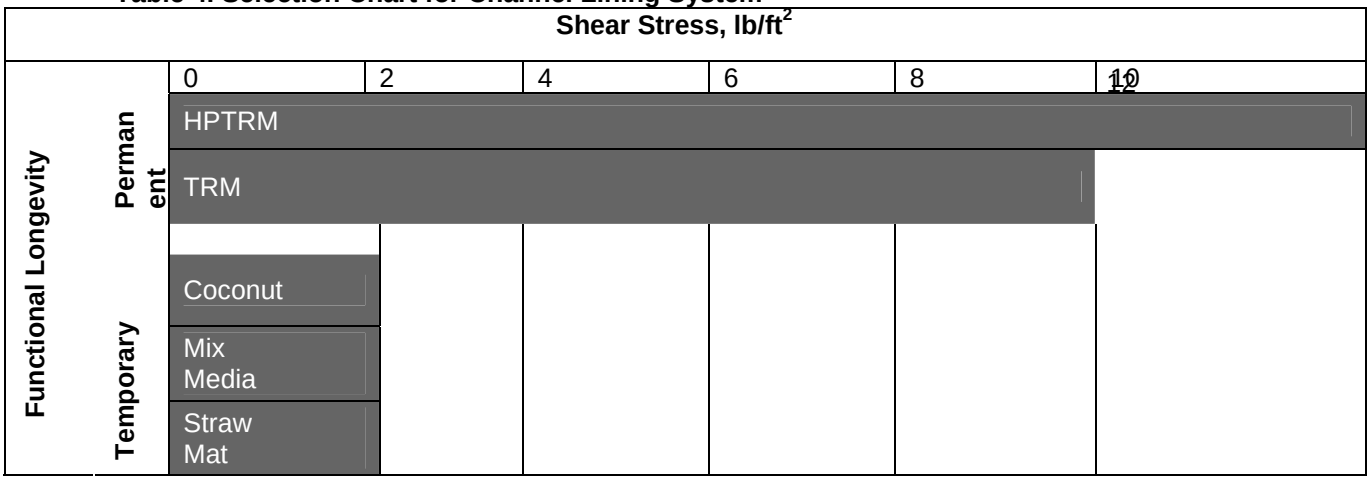
Table 3. Permanent Turf Reinforcement Mat Physical Properties

	Property	Test Method	TRM	HPTRM
General	Mass per Unit Area	ASTM D6475	10 oz/yd^2 (340 g/m^2)	14 oz/yd^2 (475 g/m^2)
General	Thickness	ASTM D6525	0.50 in (12.7 mm)	0.50 in (12.7 mm)
Index	Tensile Strength[2]	ASTM D5035	170 x 130 lb/ft (2.4 x 1.8 kN/m)	3,000 x 2,100 lb/ft[3] (43.8 x 26.3 kN/m)
Index	Elongation	ASTM D5035	50 % (max)	55 % (max)
Index	Porosity[4]	Calculated	95 %	95 %
Index	Resiliency	ASTM D6524	80 %	80 %
Index	UV Resistance[5]	ASTM D4355	80 % @ 1000 hrs	90 % @ 3000 hrs
Endurance	Functional Longevity	Observed	> 5 years	> 5 years
Performance	Maximum Velocity[6]	---	15 ft/sec (5.5m/sec)	25 ft/sec (7.69m/sec)
Performance	Maximum Shear Stress[7]	--	8 lb/ft^2 (383 N/m^2)	12 lb/ft^2 (575 N/m^2)

Notes:
1 All physical property values shall be derived from quality control testing performed by a GAI-LAP accredited lab.
2 Values of both machine and cross machine directions, respectively, under dry or saturated conditions.
3 As referenced by the proposed ECTC guidance specification to FHWA for High Survivability Turf Reinforcement Mat.

4 Porosity calculated based on unit weight, thickness and specific gravity.
5 Tensile strength retained of all components after exposure.
6 Maximum permissible design values based on short-term peak flow duration (0.5 hr), vegetated data obtained at Department-approved independent hydraulics testing facility on an erodible soil bed.
7 Shear (kN/m^3) = unit weight of water (9.81 kN/m^3) x depth (m) x slope (m/m) in a "hydraulically wide" channel. Shear (lb/ft^2) = unit weight of water (62.4 lbs/ft^3) x depth (ft) x slope (ft/ft) in a "hydraulically wide" channel.

Table 4. Selection Chart for Channel Lining System



2.03 QUALITY ASSURANCE SAMPLING, TESTING AND ACCEPTANCE

A. Rolled erosion control products (RECPs) shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with ASTM D 4354.

B. Acceptance shall be in accordance with ASTM D 4759 based on testing of either conformance samples obtained using Procedure A of ASTM D 4354, or based on manufacturer's certification and testing of quality control samples obtained using Procedure B of ASTM D 4354.

C. Quality Assurance Sampling and Testing will be waived for products manufactured at an ISO 9002 Certified Manufacturing Facility. Documentation of ISO 9002 Certification shall be provided upon request.

D. Alternate RECPs not strictly conforming to this specification must be approved by the Public Works 10 days prior to bid.

2.04 MANUFACTURING QUALITY CONTROL

A. Manufacturing Quality Control (MQC) testing shall be performed at a laboratory accredited by GAI-LAP for tests required for the turf reinforcement mat, at a frequency exceeding ASTM D 4354, with following minimum acceptable testing frequency:

Table 5. Minimum Acceptable Testing Frequency for Index Properties

Property	Test Method	Temporary Test Frequency	Permanent Test Frequency Test/yd^2 of production
Mass per Unit Area	ASTM D-5261	1/production run	1/24,000
Tensile Strength	ASTM D-5261	1/production run	1/24,000
Tensile Elongation	ASTM D-5261	1/production run	1/24,000
Ground Cover Factor	Light Projection Analysis	1/production run	1/24,000

B. Letters of certification signed by a responsible representative of the manufacturer shall be sent within 24 hrs of each truckload shipment of material to the jobsite.

PART 3. EXECUTION

3.01 SITE PREPARATION – ECBS and TRMs

A. Grade and compact areas to be treated with RECP and compact as indicated or as directed by the Public Works.

B. Remove large rocks, soil clods, vegetation, and other sharp objects (larger than 2” in diameter) that could keep the RECP from intimate contact with subgrade.

C. Prepare seedbed by loosening 50 to 75 mm (2 to 3 in) of soil below final grade. Select and apply soil amendments, fertilizer, and seed as required by the Public Works to scarified surface prior to installation of the RECP (Types 1A-3A and Types 2A-2B). For Type 3B, the contractor will additionally seed and uniformly soil fill (.5 inches) with live soil on top of the mat. Successful preparation of the seedbed will result in 50 to 75 mm (2 to 3 in) of live soil. . The Public Works has final determination of whether or not the soil is “live.” If insitu soil is not “live”, “live” soil will be imported as approved by the Public Works.

D. Construct 150 x 300 mm (6 in x 12 in) anchor trench at upgrade end of installation to inhibit undermining from stray surface water. Excavate 150 x 150 mm (6 in x 6 in) check slots at 7.6 to 9.1 meter (25 to 30 feet) intervals along length of channel. At the Public Works’ discretion, excavated check slots may be replaced by a double row of staples offset by 6 inches and placed on 1 ft centers. Cut longitudinal anchor slots 150 x 150 mm (6 in x 6 in) at top of each side slope. The aforementioned dimensions are minimums and the dimensions detailed on the drawings will control.

3.02 INSTALLATION – ECBS and TRMs

A. The following installation details are the minimums required. The installation details noted in the drawings will control the RECP installation.

1. Install the RECP at elevation and alignment indicated.

2. Beginning at downstream end in center of channel, place initial end of first roll of RECP in anchor trench and secure with ground anchor devices at 300 mm (12 in) intervals.

3. Position adjacent rolls in anchor trench in same manner, overlapping proceeding roll minimum 75 mm (3 in).

4. Secure the RECP at 300 mm (12 in) intervals along the trench, backfill and compact with specified soil or as directed by Public Works.

5. Unroll center strip of RECP upstream over compacted trench. Stop at next check slot or terminal anchor trench. Unroll adjacent rolls of RECPs upstream in similar fashion, maintaining 75 mm (3 in) overlap.

6. Fold and secure the RECP snugly into transverse check slots. Lay material in bottom of slot, and then fold it back against itself as indicated. Anchor through both layers of RECP at 300 mm (12 in) intervals. Backfill with soil and compact. Continue unrolling the RECP widths upstream over compacted slot to next check slot or terminal anchor trench.

7. Secure RECP to channel bottom with ground anchoring devices at a frequency of 3 anchors per square meter (2 ½ anchors per square yard). Anchors should be a minimum of 8 gauge and 200 mm (8 in) in length or so that they have sufficient ground penetration to resist pullout. Increased anchoring frequency may be required if site conditions are such that the Public Works determines it necessary.

8. At the discretion of the Public Works, certain TRM's can be soil filled to improve vegetative establishment and performance. If specified in the project plans or specifications, after seeding, spread and lightly rake ½" of fine topsoil into the TRM. Smooth soil fill in order to just expose top of TRM. Do not place excessive soil above mat.

9. At the Public Works' discretion a manufacturer's designated representative shall be on site for installation assistance.

10. Any installation of angular placement, overlapping around curves, or modified placement methods must be detailed on the construction drawings.

11. Public Works must approve alternate installation methods prior to execution.

3.03 Irrigation, Mowing and Project Acceptance

A. Prior to project acceptance by the Public Works, it shall be the responsibility of the contractor to establish a minimum of 70% of the area seeded shall be covered with the specified vegetation with no bare or dead spots greater than 10 square feet. The contractor shall be responsible to set up and maintain temporary irrigation, as required, to assist in establishment of vegetation.

B. All areas that erode prior to project acceptance shall be repaired at the expense of the contractor including necessary reseeding, watering, and repair of the RECP.

C. Seeded areas shall not be mowed prior to establishment of 70% vegetative density and a minimum grass growth of 3 inches. Mower height shall not be set lower than 3 inches. Throughout the duration of the project, the contractor shall be responsible for mowing to facilitate growth and shall not let the vegetation in the seeded areas exceed 18". In addition, the

D. Contractor shall water all grassed areas as often as necessary to establish satisfactory growth and to maintain its growth throughout the duration of the project.

END OF SECTION

SECTION 02951

PAVEMENT REPAIR AND RESURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repairing and resurfacing streets, highways, driveways, sidewalks, and other pavements that have been cut, broken, or otherwise damaged during construction.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for pavement repair and resurfacing under this Section. Payment will be in accordance with Measurement and Payment for work as required in appropriate sections.

2. Refer to Section 01270 - Measurement and Payment for other unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 MATERIALS

A. Subgrade:

1. Provide backfill material as required by applicable excavation and fill sections (Sections 02315 through 02319) and Section 02330 - Embankment.

B. Base: Provide base material as required by applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 – Flexible Base.

C. Pavement: Provide paving materials as required by applicable portions of Section 02741 - Asphaltic Concrete Pavement, Section 02751- Concrete Paving, Section 02754 - Concrete Driveways, and Section 02771 - Curb, Curb and Gutter, and Headers, and Section 02775 - Concrete Sidewalks.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify City prior to commencement of excavation in pavement for which an Excavation in Public Way permits has been obtained. Follow directions contained in the permit.

B. Conform to requirement of Section 02221 - Removing Existing Pavements and Structures, for removals.

C. Saw cut pavement 18-In. wider than width of trench needed to install utilities unless otherwise indicated on Drawings.

D. When removing pavement to existing deformed metal strip (i.e. dummy joint), saw cut pavement minimum 2-In. deep on opposite side of deformed metal strip. Place saw joint far enough behind deformed metal strip to obtain continuously straight joint. Remove damaged portion of deformed metal strip as required to provide proper joint. Saw cut and remove metal strip before placement of new concrete pavement.

E. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, protect undisturbed subgrade that is to remain to support replacement slab.

F. Dowel in existing pavement where no reinforcement is found or is broken due to construction activities. Unless otherwise directed by Public Works, provide No. 6 bars 24-In. long, drilled and embedded 8-In. into center of existing slab with 'PO-ROC' epoxy grout or approved equal. Space dowels to match new pavement reinforcement spacing.

G. Provide transitional paving and earthwork as required to tie proposed pavement to existing pavement when unable to dowel new pavement into existing pavement.

3.02 INSTALLATION

A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.01, Materials.

B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings and City of Schertz Standard Detail 02951.01. Curbs and curbs and

gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.01, Materials.

C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings. Place types and spacing of joints to match existing or as indicated on Drawings.

D. Where existing pavement consists of concrete pavement with asphaltic surfacing, resurface with minimum 2-In. depth asphaltic pavement.

E. Repair state highway and county crossings in accordance with TxDOT permit or county requirements as appropriate and within 1 week after utility work is installed.

3.03 WASTE MATERIAL DISPOSAL

A. Dispose of waste material in accordance with requirements of Section 01576 – Waste Material Disposal.

3.04 PROTECTION

A. Maintain pavement in good condition until completion of work.

B. Replace pavement damaged by Contractor's operations at no cost to City.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SCOPE

Includes furnishing all materials, equipment, transportation and facilities, and performing all labor necessary for constructing Concrete Formwork.

1.02 SUBMITTALS

A. Construction Joints. Submit diagram for proposed construction joints not shown on the Drawings prior to or concurrent with reinforcing bar shop drawings.

B. Form Ties-Tapered Through Bolts. Proposed method of sealing form tie hole; coordinate with details shown.

PART 2 PRODUCTS

2.01 MATERIALS

A. Forms

1. Wood forms for unexposed concrete surfaces shall be built of No. 2 Common Southern Yellow Pine Lumber or other material of equal qualifications (subject to the checking of the OWNER) of sufficient thickness to be capable of sustaining the loads to be imposed thereon, dressed to uniformly smooth contact surfaces, and so constructed as to be readily removable.

2. Wood forms for all slabs shall be faced with presanded High Density Overlay (HDO) concrete form plywood, equivalent to Simpson A-Matte or Regular Formguard or better. All joints shall be caulked.

3. Wood forms for other exposed concrete surfaces shall be constructed of Commercial Standard Douglas Fir, moisture-resistant, concrete form plywood, not less than five (5) ply, and at least nine-sixteenths inch (9/16") thick, with one (1) smooth face.

B. Form Ties

1. Form ties for exposed concrete surfaces shall be manufactured to allow a positive break back of no less than one inch (1") inside the concrete surface. Ties shall be equipped with a plastic cone of not less than five-eighths inch (5/8") diameter and one inch (1") long which will completely cover the hole and prevent the leakage of any mortar.

2. Form ties for unexposed surfaces shall be bolt rods or patented devices having a minimum tensile strength of three thousand (3,000) pounds when fully assembled. Ties shall be adjustable in length and free of lugs, cones, washers or other features which would leave a hole larger than seven-eighths inch (7/8") in diameter, or depressions back of the exposed surface of the concrete. Ties shall be of such construction that, when the forms are removed, there will be no metal remaining within one inch (1") of the finished surface of the concrete.

C. Form Oil. Nonstaining, free of kerosene oils, waxes or resins, L&M Construction Chemical "DEBOND" or Non-Crete Chemicals "Chemical Form release".

D. Corner Chamfer. 3/4 inch polyvinyl chloride form strip equal to CSF type as manufactured by Burke Concrete Accessories, Inc.

E. Carton Forms. Shall be one of the following types or an approved equal:

1. Voidco Fiberboard Void Forms

2. Savway Carton Forms

F. Form Sealer

1. Surface sealer that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces when applied to most forms or form liners. A ready-to-use water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulations.

2. Manufacturer: Master Builders, Inc., Rheofinish.

2.02 FORM TOLERANCES

A. General: Surface, design, and construct forms in accordance with applicable portions of ACI 347-89 and ACI 318-89 and the following tolerances for finishes specified.

B. Wall Tolerances

1. Straight Vertical or Horizontal Wall Surface. Flat planes with tolerance specified.

2. Surface Finish. As specified in Section "Structural Concrete."

3. Wall Type W-A.

a. Plumb with 1/4 inch in 10 feet or within 1 inch in entire height from top to bottom for walls over 40 feet high.

b. Depressions in Wall Surface. Maximum 5/16 inch when 10-foot straightedge is placed on high points in all directions or at any location.

c. Wall Thicknesses. Maximum 1/4 inch minus or 1/2 inch plus from dimensions shown.

4. Wall Type W-B.

a. Plumb within 1/8 inch in 10 feet or within 1/2 inch in entire height from top to bottom for walls over 40 feet high.

b. Depressions in Wall Surface. Maximum 1/8 inch when 10-foot straightedge is placed on high points in all directions or at any location.

c. Wall Thicknesses. Maximum 1/4 inch minus or 1/2 inch plus from dimensions shown.

C. Slab Tolerances.

1. Exposed Slab Surfaces. Comprise of flat planes as required within tolerances specified.

2. Slab Finish Tolerances and Slope Tolerances. Crowns on floor surface not to be too high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow a block of twice the tolerance in thickness to pass under the supported 10-foot straightedge.

3. Slab Type S-A. Steel gauge block 5/16-inch thick.

4. Slab Type S-B. Steel gauge block 1/8-inch thick.

5. Slab Type S-A and S-B.

a. Finish Slab Elevation. Slabs designed to slope to floor drain and gutter will adequately drain regardless of tolerances.

b. Thickness. Maximum 1/4 inch minus or 1/2 inch plus from thickness shown, except where thickness tolerance will not affect slope, drainage, or slab elevation.

D. Beams and Columns Tolerances.

1. Exposed Straight Horizontal and Vertical Surfaces. Flat planes within tolerances specified.

2. Beam Type B-A.

a. Physical Dimensions. Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.

b. Elevations. Within 1/2 inch plus or minus except where tops of beams become part of finished slab. In this case refer to slab tolerances.

3. Column Type C-A.

a. Physical Dimensions. Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.

b. Plumb within 1/4 inch in 10 feet in all directions with maximum 1/2 inch out-of-plumb at top with respect to bottom.

PART 3 EXECUTION

3.01 MATERIAL STORAGE

Form lumber shall be delivered to the job site as far in advance of its use as is practical, and shall be carefully stacked clear of the ground in such a manner as to facilitate air-drying.

3.02 GENERAL

A. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the CONTRACTOR. Formwork tolerances shall conform to ACI 301.

B. All concrete members shall be adequately shored to safely support all loads and lateral pressures outlined in "Recommended Practice for Concrete Formwork" (ACI 347) without distortion, excessive deflection or other damage.

C. All necessary forms, centering, shores and molds shall be built to conform to the shapes, lines and dimensions of the various members of concrete construction, as shown or scheduled on the Drawings. They shall be sufficiently tight and so substantially assembled as to prevent bulging, or the leakage of mortar. All forms shall be assembled to facilitate their removal without damage to the concrete.

D. Provide temporary openings at the bottom of walls, columns, and elsewhere as required to facilitate cleaning, drainage and observation.

E. Construct forms with such care as to produce concrete surfaces which will not have unsightly or objectionable form marks in exposed concrete surfaces. Lumber once used as forms shall have all contact surfaces thoroughly cleaned before reuse.

3.03 FORM TIES

Form ties shall be employed in such places and at such intervals as to securely hold the forms in position during the placing of concrete, and to withstand the weight and pressure of the wet concrete. Ties of a type intended to be entirely removed shall be coated with an acceptable lubricant to safeguard against damaging the concrete during such removal. The use of wire ties will not be permitted.

3.04 WOOD STRIPS, BLOCKING AND MOLDINGS

Place in the forms wood strips, blocking, moldings, nailers, etc., as required to produce the finished profiles and surfaces shown on the Drawings and to provide nailing for wood members or other features required to be attached to concrete surfaces in such manner. Coat wood strips, blocking, and molding with form oil.

3.05 CHAMFERS

All exposed external angles of concrete members shall have 3/4" chamfer strips placed in the forms to relieve the angles.

3.06 FORM COATING

Coat the contact surfaces of all wood forms, before placing any metal reinforcement, with form oil.

3.07 CONSTRUCTION JOINTS

A. Except as otherwise specifically indicated on the Drawings, each pier, column, beam, wall and slab shall be considered as a single unit of operation, and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, the same shall be located at or near the midpoints of spans.

B. Additional construction joints shall not be made under any circumstances without the written authorization of the OWNER. All construction joints must be either plumb or level. Provide appropriate keys in all construction joints, whether horizontal or vertical.

3.08 WALLS

Construct concrete walls to the heights, thicknesses and profiles shown on the Drawings. Provide temporary openings at the bottom of all wall forms to facilitate cleaning and observation. Close such openings securely immediately in advance of pouring concrete in the wall forms. Provide appropriate keys and haunches in walls to receive edges of concrete floors.

3.09 COLUMNS

Columns shall be of the sizes and shapes shown on the Drawings. Provide temporary openings at the bottom of all column forms to facilitate cleaning and observation, and close the same securely before placement of concrete.

3.10 BEAMS AND JOISTS

A. Concrete beams and joists shall be of sizes and shapes as shown.

B. Joists forms may be reconditioned and reused if they meet all other specification requirements.

3.11 SLABS

A. Form all openings in concrete slabs as required for the vertical passage of ducts, pipes, conduits, etc.

B. All structurally supported concrete slabs shall be poured, on wood or metal forms, to the required thicknesses as indicated or scheduled.

3.12 MISCELLANEOUS

A. Construct forms for any and all items for concrete work required for or in connection with the satisfactory completion of the project, whether each such item is specifically shown or referred to or not.

B. Do not sleeve any columns or beams unless such sleeves are indicated on the structural drawings.

3.13 REMOVAL OF FORMS

A. Forms shall not be removed until the concrete has adequately hardened and set. Clamps or tie rods may be loosened twenty-four (24) hours after the concrete is placed; ties, except for a sufficient number to hold the forms in place, may be removed at that time.

B. Through-wall ties that are to be wholly width drawn shall be pulled toward the inside face of the respective wall or beam. Cutting ties back from the face of the concrete will not be permitted, and care shall be exercised to avoid spoiling concrete surfaces.

C. Formwork for beam soffits and slabs and other parts that support the weight of concrete shall remain in place until the concrete has reached 75% of it s specified 28 calendar day strength, unless otherwise specified or permitted.

D. When reshoring is permitted or required, the operations shall be planned in advance and shall be subject to review by the OWNER. Reshoring shall comply with ACI 301, "Specifications for Structural Concrete for Buildings".

E. Under normal conditions, the minimum period of time to be allowed to elapse before forms may be removed shall be as indicated in the table below, but its observance shall not operate to relieve the CONTRACTOR of the responsibility for the safety of the structure.

Temperature	**Above 60°F**	**50 to 60°F**	**40 to 50°F**	**Less than 40°F**
Side Forms of Beams & Walls	3 Days	5 Days	7 Days	See Note
Bottom Forms of Slabs	7 Days	7 Days	10 Days	See Note

NOTE: When temperatures below forty (40) degrees Fahrenheit prevails, the forms shall remain in place an additional period equal to the time the structure has been exposed to such lower temperature.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL:

1.01 SECTION INCLUDES

A. This section includes furnishing all materials, equipment, transportation and facilities, and performing all labor necessary for preparation and submittal of shop drawings, and furnishing and placing reinforcing steel.

1.02 SUBMITTALS:

A. Shop Drawings.

1. Prepare in accordance with CRSI Manual of Standard Practice (MSP-2-01) and ACI Detailing Manual (SP-66) latest revision:

   a. Bending lists.

   b. Placing drawings.

2. Shop drawings showing weld splice, Cadweld splice, and/or mechanical threaded splice where required or where proposed.

3. Welded Wire Fabric. Furnish detailed shop drawings if proposed to use minimum yield strength of 75 ksi in lieu of ASTM A615 reinforcing bars, or 60 ksi panels meeting ASTM A185 or A497 and ACI 318, latest revisions.

B. Quality Control Submittals.

1. Mechanical Threaded Connections.

   a. Provide verification that device threads have been checked and meet all requirements for thread quality, in accordance with manufacturer’s published methods.

2. Mill Test Reports. Certified copies, evidencing compliance with the requirements of these Specifications, shall be delivered to the OWNER with all deliveries of reinforcing steel.

1.03 DELIVERY, STORAGE, AND HANDLING:

Unloading, storing and handling bars on the job shall meet CRSI publication "Placing Reinforcing Bars", and the following:

A. Deliver steel with suitable hauling and handling equipment.

B. Tag steel for easy identification.

C. Store to prevent contact with the ground.

PART 2 PRODUCTS:

2.01 DEFORMED BILLET-STEEL REINFORCING BARS:

A. Meet ASTM A615, Grade 60, including Supplemental Requirements S1 where welding is not required, or meet ASTM A706, Grade 60, including Supplemental Requirements for reinforcing to be welded.

B. Stirrups and Column Ties. Grade 40 bars.

2.02 SPLICES AND MECHANICAL CONNECTIONS:

A. Metal Sleeve. If used for splice, provide with cast filler metal, capable of developing in tension or compression 100 percent of specified minimum tensile strength of the bar, as manufactured by:

1. Erico Products, Inc., Cleveland, OH, Cadweld T-Series.

2. Or equal.

B. Mechanical Threaded Connections. Metal coupling sleeve for use on splicing reinforcing in secondary members or in areas of low stress with internal threads which engage threaded ends of bars to be spliced, and develops in tension or compression 125 percent of the specified yield strength of the bar, as manufacture by:

1. Erico Products, Inc., Cleveland, OH, Lenton Reinforcing Steel Couplers.

2. Richmond Screw Anchor Co., Inc., Fort Worth, TX, Richmond DB-SAE Dowel Bar Splicers.

2.03 WELDED WIRE FABRIC FOR SINGLE LAYER REINFORCED SLAB ON GRADE APPLICATIONS:

A. Wide spaced standard, flat sheets, structural welded wire fabric, with same steel area as bars shown.

B. Minimum yield strength of 75 ksi may be provided in lieu of ASTM A615 reinforcing bars, or 60 ksi, provided panels meet ASTM A185 or A497 and ACI 318, latest revisions, and if approved on submittal as specified.

C. Manufacturer:

1. Davis Walker Corp.

2. Or equal.

2.04 ACCESSORIES:

A. Tie Wire.

1. 16-gauge, black, soft-annealed wire where tie wire is not closer than 1 inch from surface of wall after tying in place.

2. Provide nylon-, epoxy-, or plastic-coated tie wire to fasten non-coated reinforcing steel, unless tie wire is bent to maintain a minimum of 1 inch from surface of wall.

B. Bar Support and Spacers.

1. Precast concrete bar supports, cementitious fiber-reinforced bar supports, or all-plastic bar supports and side form spacers meeting the requirements of the CRSI 1988 Supplement to Manual of Standard Practice, 24th Edition, 1986. Other types of supports or spacers shall not be used.

2. In Beams, Columns, Walls, and Slabs Exposed to View After Stripping. Small rectangular concrete blocks made up of same color and same strength as concrete being placed around them or all-plastic bar supports and side form spacers.

3. Coat wire projecting from precast concrete bar supports with dielectric material, epoxy, or plastic.

4. Provide precast concrete supports for reinforcing in concrete placed on grade.

PART 3 EXECUTION:

3.01 GENERAL:

A. Meet requirement in a manual titled, “Placing Reinforcing Bars”, published by Concrete Reinforcing Steel Institute (CRSI).

B. Bend all bars cold.

C. Notify OWNER when reinforcing is ready for inspection and allow sufficient time for this inspection prior to placing concrete.

3.02 PLACING REINFORCING STEEL:

A. Clean metal reinforcement of any loose mill scale, oil, earth, and other contaminants.

B. Bundle or space bars as approved on shop drawings, instead of bending where construction access through reinforcing is necessary.

C. Install in accordance with approved shop drawings.

D. Protection, Spacing and Positioning. Conform with reviewed placing drawings, design drawings, and current edition of the ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318).

E. Location Tolerances. Meet current edition of "Placing Reinforcing Bars", published by Concrete Reinforcing Steel Institute and the Details and Notes on the Drawings.

F. Splicing.

1. As shown and as specified in current edition of ACI 318.

2. Use lap splices unless otherwise shown or permitted in writing by OWNER.

3. Welded Splices. Accomplish by full penetration groove welds as specified to develop at least 125 percent of specified yield strength of the bar.

4. As an alternative, perform splices using metal sleeve as specified.

5. Stagger splices in adjacent bars.

G. Tying Deformed Reinforcing Bars.

1. Meet current edition of "Placing Reinforcing Bars", published by Concrete Reinforcing Steel Institute and the Details and Notes on the Drawings.

2. Tie every other intersection on mats made up of #3-#4-#5-#6 in such a manner to hold bars at required spacing.

3. All non-coated tie wire shall be bent to prevent the tie wire from being closer than 1 inch from the surface of the concrete. Wire that is found to be close after the pour shall be chipped out to a depth of 3/4 inch, cut off, and the hole patched.

H. Reinforcement Around Openings.

1. Place an equivalent area of steel around pipe or opening and extend on each side sufficiently to develop bond in each bar.

2. Refer to Details on Drawings for bar extension length of each side of opening.

3. Where welded wire fabric is used, provide extra reinforcing using fabric or deformed bars.

I. Welding Requirement.

1. Do not perform any welding unless required submittal is approved as specified.

2. Meet ASTM A706. Do not weld other bars.

3.03 PLACING WELDED WIRE FABRIC:

A. Extend fabric to within 2 inches of edges of slab, and lap splices at least 1-1/2 courses of fabric or minimum 8 inches.

B. Tie laps and splices securely at ends and at least every 24 inches with 16-gauge black annealed steel wire.

C. Place welded wire fabric on concrete blocks at proper distance above bottom of slab and rigidly support equal to that furnished for typical deformed bar reinforced steel.

D. Meet current ACI 318 and current Manual of Standard Practice, Welded Wire Fabric, by the Wire Reinforcement Institute regarding placement, bends, laps and other requirements.

E. Do not use fabric that has been rolled. Install flat sheets only.

3.04 FIELD BENDING:

A. Straightening and Re-bending. Do not straighten or re-bend metal reinforcement. Field bending of reinforcing steel bars is not permitted.

B. Unless permitted by OWNER, do not cut reinforcing bars in the field.

3.05 MECHANICAL SPLICES AND CONNECTIONS:

A. Use only in areas specifically approved in writing by the OWNER.

B. Install as required by manufacturer.

C. Carefully inspect each splice and verify that each component meets manufacturer's requirements.

D. Maintain minimum edge distance and concrete cover.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL:

1.01 SECTION INCLUDES

A. The work included in this section encompasses all cast-in-place concrete structures, such as manhole bases, storm water inlets, junction boxes, headwalls and other miscellaneous structures as may be required. Specifically, this work is comprised of all labor, equipment, tools, materials, and supervision necessary to complete all cast-in-place concrete structures in accordance with the Plans or herein specified, including concrete finishing, patching, grouting, crack repair, installation of all embedments, concrete curing, and sealing of joints in liquid containing structures.

1.02 REFERENCE STANDARDS:

A. Except as modified herein, concrete work shall conform to the requirements of ACI 318, latest revision.

1.03 SOURCE QUALITY CONTROL:

A. Code Requirements. Unless otherwise specified herein or shown on the Plans, all work shall conform to the applicable requirements of the Uniform Building Code, latest edition.

1.04 SUBMITTALS:

A. At least 30 days before any class of concrete is to be placed, the CONTRACTOR shall submit for approval by the ENGINEER, mix designs for each proposed mix. All mixes are to be made by testing laboratory, approved by the OWNER.

PART 2 PRODUCTS:

2.01 PORTLAND CEMENT:

A. Portland cement shall be the domestic standard brand conforming to the requirements of ASTM C150, Type I. It shall be tested in accordance with the provisions of ASTM C150 with a tensile strength test conducted at seven days. It shall be tested at a frequency of one test for every 250 barrels of cement.

2.02 AGGREGATES:

A. Stone aggregates shall be furnished from approved pits that are free from opaline, chert, feldspar, mica, siliceous magnesium limestone or other deleterious or reactive substances and shall conform to the requirements of ASTM C33. Fine aggregates shall pass a #4 sieve. Other requirements include:

1. Coarse aggregates shall be clean, hard, fine-grained crushed rock or washed gravel.

2. Aggregate shall be tested in accordance with the following standards presented in Table 1.

Table 1 Aggregate Testing Standards

Test	Standard Reference	Performance Requirement
Sieve Analysis	ASTM C136	
Organic Impurities	ASTM C40	Fine aggregate shall not develop a color that is darker than the reference color.
Soundness	ASTM C88	Loss from 5 cycles shall not exceed 18% for coarse aggregate or 10% for fine aggregate.
Abrasion of Concrete Aggregate	ASTM C131	Loss after 100 revolutions shall not exceed 10-1/2%; loss after 500 revolutions shall not exceed 42%.
Deleterious Materials	ASTM C33	
Material finer than No. 200 Sieve	ASTM C117	Shall not exceed 1% for gravel or 1.5% for crushed aggregate per ASTM C33.
Reactivity Potential	ASTM C289	Ratio of silica released to reduction in alkalinity shall not exceed 1.0.

B. Aggregate shall be tested once for every 100 cubic yards of batched concrete.

C. All sampling and testing shall be performed by an OWNER approved testing laboratory at the expense of the CONTRACTOR (to be covered by the Testing Allowance, reference Section 01400). Additional costs caused by re-testing or re-inspection that result from faulty materials or workmanship shall be borne by the CONTRACTOR.

2.03 CONCRETE MIXES:

A. The CONTRACTOR shall mix, place, and cure concrete that shall be of 145 pounds per cubic foot, nominal density, and that complies with the class characteristics shown in table 2.

Table 2 Class Characteristics of Concrete

	Minimum Compressive Strength after 28 days	Maximum Water-Cement Ratio	Slump Range in Inches	Min./Max. Sacks of Cement per cubic yard
A	3,000	7.0	2 - 5	5.0
B	2,500	8.0	2 - 5	4.5
C	2,000	9.0	1 - 4	4.0
D	1,000	11.0	1 - 4	2.0
G	as specified on Plans	5.50	2 - 3	6.0 / 8.0

B. Concrete shall be ready-mixed, supplied from an off-site commercial ready mix plant approved by the OWNER. Each load will be accompanied by a bonded weightmaster's certificate listing the quantity of each concrete ingredient, admixture quantity, water content, slump, and time of loading and departure from the ready mix plant.

C. Unless otherwise approved in advance of batching, all concrete of a single design mix for any one day's placement shall be from a single batch plant of a single supplier.

D. Ready mix concrete shall not be held in the mixer for more than 90 minutes after the time water is added. Concrete shall not be delivered to the job site with the total specified amount of water already added. The CONTRACTOR shall withhold 2-1/2 gallons of water per cubic yard at the batch plant, so that it may be added at the job site prior to discharge from the mixer truck. Adding water at the job site shall be done under the supervision of the OWNER.

E, The amount of water added at the job site shall be carefully adjusted so as not to exceed the maximum slumps or water cement ratios specified in Table 2. Consistency shall be measured in accordance with ASTM C143. Concrete that exceeds the maximum slump shall be rejected.

2.04 ADMIXTURES:

A. Admixtures used on this project will all come from one manufacturer. Admixtures used in combination shall be physically and chemically compatible and shall be so certified by each admix manufacturer and by the testing laboratory that prepared the mix designs.

B. In all Class A concrete and, at the CONTRACTOR'S option, in all Class B concrete, in amounts recommended by the manufacturer, as approved by the ENGINEER, the CONTRACTOR may use water-reducing, retarding chemical admixture conforming to ASTM C 494, Type D. The admixture shall provide the following:

1. Decrease drying shrinkage.

2. Increase compressive strength at all ages up to 5 years.

3. Increase flexural strength.

4. The water cement ratio and required strengths shall be maintained as scheduled.

5. There shall be no loss of workability resulting from a reduction in slump.

C. Use air entrainment additive conforming to ASTM C260 as approved by the ENGINEER. Concrete subject to freezing and thawing after curing, shall contain air entrainment in accordance with ACI 318 and ACI 301, latest edition.

D. At the CONTRACTOR's option, as approved by the ENGINEER, the CONTRACTOR may use a high range water reducing admixture (superplasticizer) conforming to ASTM C494 to increase workability.

2.05 EXPANSION JOINT MATERIAL:

A. Expansion joint material shall be type I, preformed sponge neoprene expansion joint filler conforming to AASHTO M153.

2.06 CONCRETE JOINT SEALANTS:

A. Concrete joints that will be immersed or intermittently immersed in water shall be sealed with Karlee Company's "Lastex M" 100 percent solids polyurethane sealant, Mameco International's Vulkem 227, Mameco International's Vulkem 45, Mameco International's Vulkem 245, Hunt's Seal Flex 227-U Special Reservoir Grade polyurethane sealant, or approved equal.

B. The primer used prior to application of the sealant shall be that recommended by the sealant manufacturer.

C. The back-up preformed joint filler shall consist of a closed cell polyethylene foam or equal impervious, compatible, compressible foam material recommended for retaining sealant depth in expansion joints while curing. Bitumen based or oil saturated material will not be acceptable.

D. Bond breakers shall be polyethylene tape or equal as recommended by the sealant manufacturer to prevent adherence to the backup material.

2.07 NON-SHRINK GROUT:

A. The CONTRACTOR shall use Masterflow 713, manufactured by Master Builders, or equal nonmetallic, non-shrinking, non-staining, premixed, water and oil resistant, high strength grout that meets or exceeds US Army Corps of Engineer standard specification CRD-C621-80.

2.08 EPOXY ADHESIVES:

A. Epoxy adhesives used for crack repair, grouting, patching, bonding or other uses shall be manufactured by Adhesive Engineering Company, Sika Chemical Company, or equal. The CONTRACTOR shall use the products of one manufacturer. Mixing products from multiple manufacturers will not be allowed.

B. For bonding new concrete to old concrete and for grouting metal anchors, the CONTRACTOR shall use Sika's Sikadur Hi-Mod, Adhesive Engineering Company's Concresive 1001-LPL, or equal.

C. For patching concrete surfaces, making high strength epoxy grout or concrete, and for grouting metal anchors use Sika's Sikadur Hi-Mod LV, Adhesive Engineering Company's Concresive Structural Concrete Bonding Process System, or equal.

D. For pressure injection or gravity feed grouting use Sika's Sikadur Hi-Mod LV, Adhesive Engineering Company's Concresive Structural Concrete Bonding Process System, or equal.

2.09 LIQUID CONCRETE CURING COMPOUND:

The curing compound shall be TLF or Clear All Resin Base by Hunt Process Company, Burke Rez-X, or equal. It shall conform to the requirements and provisions of ASTM C309 and shall not prove detrimental to the surface of the concrete.

2.10 SHEET CURING MATERIALS:

Sheet curing materials shall conform to the requirements of ASTM C171 and shall consist of waterproof paper, polyethylene film, or white burlap-polyethylene sheets. Any sheet materials selected for use shall be non-staining.

PART 3 EXECUTION:

3.01 PREPARATION BEFORE PLACING:

A. Remove excess water from forms prior to placing concrete. Divert any flow from washing over freshly placed concrete. Remove hardened concrete, debris, and foreign materials from interior of forms and from inner surfaces of mixing and conveying equipment.

B. Reinforcement and forms shall have been installed in accordance with the provisions of Section 03100, Concrete Formwork and Section 03200, Concrete Reinforcement. Embedded metal shall be free from old mortar, oils, mill scale, and other encrustations or coatings that might reduce bonding.

C. Wet wood forms sufficiently to tighten up cracks and to reduce suction and maintain concrete workability.

D. Fine grade subgrade so that it is smooth and level. Subgrade should be lightly dampened 24 hours in advance of placing. When aggregate fill bases are specified, place 30 mil plastic sheeting on the base course to retain mix fines within the mix and prevent their migration into the base course.

E. For those surfaces to which new work is to be bonded, conform to the requirements herein specified in paragraph 3.02, Joints in Concrete. For abutting surfaces that are not to be bonded to new work, clean surfaces to remove dirt and other deleterious substances which may contaminate or interfere with the new work.

3.02 JOINTS IN CONCRETE:

A. Locate joints in concrete where shown on the Plans or otherwise approved.

B. Unless otherwise shown, all construction joints shall be provided with keyways. Clean and roughen contact surfaces of construction joints by removing the entire surface and exposing clean aggregate solidly embedded in the mortar matrix. Use mechanical chipping or sandblasting, or application of surface retarder followed by washing and scrubbing with a stiff broom. Cover and protect all inserts from damage. The hardened concrete shall be watered and kept wet for at least 24 hours before placing new concrete. Just prior to placing adjoining concrete, slush face of construction joints with 1:2 mix of cement and sand mixed to paint consistency.

C. Expansion joints shall be used to relieve slab pressures where exterior slabs abut structures and where slabs abut equipment pads. They shall be provided where shown on the Plans and shall be a minimum of ½ inch in width, unless otherwise detailed. Except where sealed joints are shown or specified, provide expansion joint filler and joint sealer. The joint filler shall be held down below the level of the slab at least ½ inch. Joint sealer shall then be installed and finished flush with the slab surface.

D. The CONTRACTOR shall make concrete pours for slabs on grade and other structural slabs in a checkerboard pattern sequence. Make concrete pours for walls in an alternating pattern sequence between indicated construction joints. In place concrete shall be cured at least seven days before placing an abutting section.

3.03 PLACING CONCRETE:

A. The base slabs of inlets, junction boxes, headwalls, culverts, and other structures shall be placed and allowed to set before the remainder of the structure is constructed. Sidewalls shall be bonded to the base slab in accordance with the provisions specified herein in paragraph 3.02, Joints in Concrete.

B. The top slabs of culverts and like structures may be placed monolithically with the walls, provided the walls are placed and allowed to set at least one hour, but no more than two hours shall elapse between placing the concrete in the wall and the top slab.

C. All concrete shall be placed with the aid of mechanical vibrating equipment supplemented inside the forms. Vibrating equipment shall be of the internal type and shall maintain a speed of 6,000 impulses per minute when submerged in concrete. Vibrators shall be adequate in number of units to properly consolidate all concrete. Form or surface vibrators shall not be used. The duration of vibration shall be limited to that required to properly consolidate the concrete without causing segregation of the aggregates in the concrete. Insertion of vibrating equipment into lower layers of concrete that have begun to set shall be prohibited.

D. Concrete shall not be allowed to drop freely for more than five feet in unexposed work, nor more than three feet in exposed work. Where greater drops are required, a tremie or other approved means shall be employed.

E. Concrete shall not be placed when the ambient temperature is less than 40 degrees F. during the first 72 hours of the curing period, polyethylene sheeting or burlap-polyethylene blankets shall be placed in direct contact with the concrete. When concrete is placed in temperatures above 85

degrees an approved retarding agent, meeting the requirements of paragraph 2.04, Admixtures will be required in all concrete used in superstructures and top slabs of culverts.

3.04 FORM REMOVAL:

A. Forms shall be removed only with the approval of the ENGINEER and in a manner to ensure complete safety of the structure where the structure is supported on shoring. Form removal from structures shall not begin until the concrete has attained the following required compressive strengths:

1. Vertical forms shall not be removed until the concrete has set a minimum of 24 hours and has attained a minimum compressive strength of 500 psi.

2. When wall and top forms are placed monolithically, wall forms shall not be removed until the concrete has attained a minimum strength of 2,000 psi.

3. Forms for the top slab shall not be removed until the top slab has attained a minimum compressive strength of 2,000 psi.

3.05 FINISHES:

Finishes for concrete surfaces shall comply with the following:

A. Rough Finish - Concrete for which no other finish is indicated or specified shall have fins and rough edges removed.

B. Smooth Finish - Smooth finish shall be given to the interior of junction boxes, inlets, culverts, and other structures indicated on the Plans. Joint marks, fins, and rough edges shall smoothed off and blemishes shall be removed leaving finished surfaces smooth and unmarred subject to approval by the ENGINEER.

C. Floor Finish - Floor finish shall be given to the floors of all inlets, culverts, and other structures, and shall be struck off true to the required grade as shown on the Plans and floated to a smooth, even finish by manual or mechanical methods. No coarse aggregate shall be visible after finishing.

D. Rubbed Finish - All exposed surfaces of retaining walls, wing walls, headwalls, and other structures after patching and pointing has been completed, and the surface has been wetted, shall be given a first rubbing with a No. 16 carborundum stone. After the first rubbing is completed and the ground material has been evenly spread, the material shall be allowed

to reset. After sufficient aging, the surface shall be wetted and given a finish rubbing with a No. 30 carborundum stone, after which the surface shall be neatly striped with a brush and allowed to reset. On the inside surfaces of all culvert walls an area from the top of the slab, on a line 30 degrees down from vertical, to the bottom slab shall be rubbed as specified above.

E. Building Floor Finish. Building floor shall be given a steel trowel finish and be sealed using “protecrete” by Advanced Concrete Technology, Inc., Dallas, TX “Kure-NLSeal”, by Sonneborn, Minneapolis, MN or equal.

F. The entire structure shall be left with a clear neat uniform finish, free from markings and shall be uniform in color.

G. Sidewalk surfaces shall be given a wood float finish, a light broom finish, or may be striped with a brush as directed by the ENGINEER or shown in the Plans.

3.06 CURING:

A. Immediately after placing or finishing, concrete surfaces not covered by forms shall be protected from loss of surface moisture for not less than four curing days. When forms are left in place they shall be kept sufficiently wet to reduce cracks in the forms and prevent the form joints from opening. If forms are removed before four curing days have transpired, the formed surface shall be protected for the remainder of the four day period. Protection and curing shall be accomplished by one of the four following methods and shall be subject to the approval of the ENGINEER:

1. Water Curing - Water curing shall be effected by covering exposed surface with sheet curing materials. In the event white burlap-polyethylene sheets are used, these sheets shall be previously wetted before applying, and kept thoroughly wet during the entire curing period.

2. Liquid Curing Compound - Liquid curing compound shall be applied in accordance with the recommendations of the manufacturer.

END OF SECTION

SECTION 03315

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for pre-cast units, and in-place liners for manhole rehabilitation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.

2. Obtain services of and pay for certified testing laboratory to prepare design mixes.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.

H. ACI 315 - Details and Detailing of Concrete Reinforcement.

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

J. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

L. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

N. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

O. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

P. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.

Q. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

S. ASTM C 33 - Standard Specification for Concrete Aggregates.

T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

Y. ASTM C 150 - Standard Specification for Portland Cement.

Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

BB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

CC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

DD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

EE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

FF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

GG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

HH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

II. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.

JJ. CRSI MSP-1 - Manual of Standard Practice.

KK. CRSI - Placing Reinforcing Bars.

LL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

MM. NRMCA - Concrete Plant Standards.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed mix design and test data for each type and strength of concrete in work.

C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Public Works.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.05 HANDLING AND STORAGE

A. Cement: Store cement off of ground in well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cementitious Material:

1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Public Works; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.

2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of Na2O + 0.658K20.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:

1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.

2. Fine Aggregate: ASTM C 33.

3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures:

1. Water Reducers: ASTM C 494, Type A.

2. Water Reducing Retarders: ASTM 494, Type D.

3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.

3. Wire: ASTM A 82. Use 16 1/2 gauge minimum for tie wire, unless

otherwise indicated.

H. Fiber:

1. Fibrillated Polypropylene Fiber:

a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.

b. Physical Properties:

(1) Material: Polypropylene

(2) Length: ½-In. or graded

(3) Specific Gravity: 0.9l

c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.

2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.

a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.

b. Physical Properties

(1) Material: Steel

(2) Aspect Ratio (for fiber lengths of 0.5 to 2.5-In., length divided by diameter or equivalent diameter): 30:1 to 100:1

(3) Specific Gravity: 7.8

(4) Tensile Strength: 40-400 ksi.

(5) Young's Modulus: 29,000 ksi

(6) Minimum Average Tensile Strength: 50,000 psi

(7) Bending Requirements: Withstand bending around 0.125-In. diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming

compounds conforming to ASTM C 309.

2.02 FORM WORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2-In. (nominal) lumber or ¾-In. form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-In. nominal thickness or form plywood of approved thickness.

B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of ¼-In. minimum thickness, preferably oiled at mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8-In. in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.04 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Public Works for review.

C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Public Works.

D. Classification:

Class	**Type**	**Minimum Compressive Strength (Lbs.Sq.In.)**		**Maximum W/C Ration**	**Air Content (Percent)**	**Consistency Range in slump (inches)**
		7-Day	**28-Day**			
A	Structural	3200	4000	0.45	4±1	2 to 4 *
B	Pipe Block Fill, Thrust Block	-----	3000	----	4±1	5 to 7

* When ASTM C 494, Type F or Type G admixture is used to increase workability, this range may be 6 to 9.

E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.06 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:

1. Thickness: not less than 3/8-In.

2. Acceptable Manufacturers:

   a. Kirkhill Rubber Co., Brea, California

   b. Water Seals, Inc., Chicago, Illinois

   c. Progress Unlimited, Inc., New York, New York

   d. Greenstreak Plastic Products Co., St. Louis, Missouri

   e. Approved equal.

2.07 RESILIENT WATERSTOP

A. Resilient Waterstop: Where shown on Drawings; either bentonite- or adhesive-type material.

B. Bentonite Waterstop:

1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.

2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.

3. Cross-sectional dimensions, unexpanded waterstop: 1-In. by ¾-In.

4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C Adhesive Waterstop:

1. Preformed plastic adhesive waterstop at least 2-In. in diameter.

2. Meets or exceeds requirements of Federal Specification SS-S-210A.

3. Supplied wrapped completely by 2 part protective paper.

4. Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.

5. Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.

6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko- Flex Products, Inc.; or approved equal.

PART 3 EXECUTION

3.01 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back form work with sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer liner on job before using. Facing may be constructed of ¾-In. plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular ¾-In. chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least ¾-In. from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Public Works, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Public Works and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3-In. for surfaces cast against soil or subgrade, 2-In. for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of Public Works. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Public Works before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by Public Works.

3.05 PLACING CONCRETE

A. Give sufficient advance notice to Public Works (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Public Works approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4-Ft. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted

locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12-In. thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.06 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

C. Splicing PVC Waterstops:

1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with manufacturer’s printed instructions.

2. Butt end-to-end joints of two identical waterstop sections may be made in forms during placement of waterstop material.

3. Prior to placement in form work, prefabricate waterstop joints involving more than two ends to be joined together, angle cut, alignment change, or joining of two dissimilar waterstop sections, allowing not less than 24-In. long strips of waterstop material beyond joint. Upon inspection and approval by Public Works, install

prefabricated waterstop joint assemblies in form work, and butt-weld ends of 24-In. strips to straight- run portions of waterstop in forms.

D. Setting PVC Waterstops:

1. Correctly position waterstops during installation. Support and anchor waterstops during progress of work to ensure proper embedment in concrete and to prevent folding over of waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.

2. Where waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to waterstop in future concrete placement, terminate waterstop 6-In. below top of wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Specifications.

F. Resilient Waterstop:

1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.

2. When requested by Public Works, provide technical assistance by manufacturer's representative in field at no additional cost to City.

3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop minimum of 6-In. and place in contact with PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form smooth joining surface.

5. At free top of walls without connecting slabs, stop resilient waterstop and grooves (where used) 6-In. from top in vertical wall joints.

6. Bentonite Waterstop:

a. Locate bentonite waterstop as near as possible to center of joint and extend continuous around entire joint. Minimum distance from edge of waterstop to face of member: 5-In.

b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12-In., place waterstop in grooves at least ¾-In. deep and 1 ¼-In. wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5-In.

c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.

d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth when necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using epoxy grout which completely fills voids and irregularities beneath waterstop material. Prior to installation, wire brush concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

e. In addition to adhesive backing provided with waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-In. maximum spacing.

7. Adhesive Waterstop:

a. With wire brush thoroughly clean concrete surface on which waterstop is to be placed and then coat with primer.

b. If surface is too rough to allow waterstop to form complete contact, grind to form adequately smooth surface.

c. Install waterstop with top protective paper left in place. Overlap joints between strips minimum of 1-In. and cover back over with protective paper.

d. Do not remove protective paper until just before final form work completion. Place concrete immediately. Time that waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.07 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Public Works. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.

3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.08 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28 day strength, unless directed otherwise by Public Works.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.

2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Public Works. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.

2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.

3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.09 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Public Works.

3.10 DEFECTIVE WORK

A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.

B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Unless otherwise directed by Public Works, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.

1. Take concrete samples in accordance with ASTM C 172.

2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test specimens in accordance with ASTM C 31 and ASTM C 39.

3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according at ASTM C 138.

4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7 day and 28 day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Public Works, at no additional cost to City.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by City.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Public Works.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL:

1.01 SECTION INCLUDES

This section includes work necessary to provide all submittals, provide training, and furnish and install, complete, grout as specified herein. This section includes non-shrink grout and other grouts used on the project.

1.02 SUBMITTALS:

A. Quality Control Submittals. Furnish the following.

1. ASTM C1107-89a, Grade B certified testing laboratory reports, showing the grout tested at a fluid consistency for temperatures of 45 degrees F and 90 degrees F with a pot life of 30 minutes at fluid consistency. The expansion at 3 or 14 days shall not exceed the 28-day expansion and non-shrink property is not based on gas expansion.

2. Twenty-four-hour evaluation of non-shrink grout. Test and report with independent test laboratory letterhead and signature, dated within the last 18 months. Test requirements and forms are specified hereinafter on attached form. Required only for non-specified grouts.

3. Test results and service report from the demonstration and training session and from the field tests.

4. Certification based on test results proving that all grout used on the project contains no chlorides or other chemicals causing corrosion.

B. Warranty. Submit written warranty with no disclaimers as specified hereinafter.

C. Name and telephone number of grout manufacturer's representative living close enough to give regular job service at no extra cost. The representative shall have at least 1 year of experience with these grouts.

D. Contract Closeout Submittals. Manufacturer's certification of installation, including manufacturer's job service report, certifying grouts are used in accordance with manufacturer's recommendations.

1.03 WARRANTY:

A. Provide 1-year warranty for work provided under this section.

B. Manufacturer's warranty shall not contain a disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products or materials furnished or their responsibility to anything less that this specified warranty.

C. Manufacturer's warranty shall not be more limited that the warranty required under this Contract.

D. Manufacturer shall warrant participation with Contract in replacing or repairing grout found to be defective due to faulty materials, as determined by industry standard test methods.

1.04 QUALITY ASSURANCE:

A. Preinstallation Demonstrations and Training.

1. Establish a location on project site and schedule a time for the grout manufacturer's demonstration and training session of the proposed non-shrink grouts to be used on the project. The non-shrink grouts shall be mixed to specified consistency, tested, placed, and curing initiated on actual project placements such as baseplates and tie holes to provide actual on-the-job training for CONTRACTOR and OWNER.

2. Conduct the training session using a minimum of five bags for each of Category II and Category III grout, mix the grout to fluid consistency, and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1,3, and 28 days, and then use the final work for the project. The CONTRACTOR shall have the employees who will be doing this work present and have them actually participating in this training and demonstration work. The training shall include the methods for curing of the grout.

3. The grout manufacturer shall also mix sufficient Category I grout for a minimum of 15 tie holes and shall train the CONTRACTOR's employees how to perform the work and cure the grout with the employees assisting in the mixing and actual sealing of the tie holes.

4. If the project includes patching, throughbolt holes, and blockouts such as for gate guides, the manufacturer shall also mix and train the

CONTRACTOR's employees how to install and cure each of these applications.

5. Transport the test cubes to an independent test laboratory, obtain the test reports, pay for these tests, and submit a report of these demonstration and training test cube strengths to the OWNER.

PART 2 PRODUCTS:

2.01 NONSHRINK GROUTS:

A. Provide grouts free of chlorides and other chemicals that cause corrosion.

B Non-shrink Grout. Provide non-shrink grout for applications in the grout category as specified in Table 1.

Table 1 Applications for Grout

	Temperature Range	Maximum Placing Time	
Application	**40 to 100°F**	**20 min**	**Greater than 20 min**
Filling tie holes	I	I	I
Blockouts for gate guides	I or II	I	II
Precast joints	I or II	I	II
Column baseplates single-story	I or II	I	II
Machine bases 25 hp or less	II	II	II
Bases for precast wall sections	II	II	II
Baseplates for columns over one story	II	II	II
Precast base joints higher than one story	II	II	II
Through-bolt openings	II	II	II
Patching concrete walls	II	II	II
Machine bases 26 hp and up	III	III	III
Baseplates and/or soleplates with vibration, thermal movement, etc.	III	III	III

C. Nons-shrink Grout, Category I. Nonmetallic, nongas-liberating flowable grouts meeting the specified test requirements and applications.

1. A prepackaged natural aggregate grout, requiring only the addition of water. Mix, place, and cure demonstrated by the manufacturer during the demonstration and training session.

2. Meet ASTM C1107-89a requirements when tested at:

a. Flowable consistency (140 percent flow on ASTM C230, five drops in 30 seconds).

b. Flowable for 15 minutes.

c. Fluid working time of at least 30 minutes.

3. The grout when tested shall not bleed at maximum allowed water.

4. The non-shrink property of the grout shall not be based on gas or gypsum expansion.

5. Grout shall have a minimum strength of 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.

D. Non-shrink Grout, Category II. Nonmetallic, nongas-liberating, natural aggregate fluid grouts meeting the specified test requirements and applications.

1. A prepackaged natural aggregate grout, requiring only the addition of water. Mix, place, and cure demonstrated by the manufacturer during the demonstration and training session.

2. Meet the requirements of CRD-C621-89 and ASTM C1107-89a, Grade B when tested at:

a. Fluid consistency (20 to 30 seconds) per CRD-C611-89.

b. At temperatures of 45,70, and 90°F.

3. Provide certification together with independent test data that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas or gypsum expansion.

4. The fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.

5. Grout shall have a minimum strength of 2,500 psi at 1 day, 4,500 psi at 3 days, and 7,000 psi at 28 days.

6. Grout shall be pretested within the last 18 months per the hereinafter specified 24-hour grout test requirements.

E. Non-shrink Grout, Category III. Metallic, nongas-liberating fluid grouts meeting the specified test requirements and applications.

1. A prepackaged metallic aggregate grout, requiring only the addition of water. Mix, place, and cure demonstrated by the manufacturer during the demonstration and training session.

2. Meet the requirements of CRD-C621-89 and ASTM C1107-89a, Grade B when tested at:

   a. Fluid consistency (20 to 30 seconds) per CRD-C611-89.

   b. At temperatures of 45, 70, and 90°F.

   c. Fluid working time of at least 30 minutes.

3. Provide certification together with independent test data that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas or gypsum expansion.

4. The fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.

5. Grout shall have a minimum strength of 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.

6. Test per the hereinafter specified 24-hour grout test requirements.

F. Non-shrink Grout Manufacturers:

1. Master Builders Co., Cleveland, OH.

2. Euclid Chemical Co., Cleveland, OH.

3. Dayton Superior Corp., Miamisburg, OH.

G. Grout for Horizontal Construction Joints in Walls. Flowable, consisting of sand, water, and minimum 12 sacks of cement per cubic yard.

PART 3 EXECUTION:

3.01 PLACING GROUT:

A. Place and cure non-shrink grout as demonstrated by the manufacturer during the demonstration and training session.

B. Non-shrink Grout, Category I and II. For formwork tie holes or through-bolt holes, fill space with dry pack dense grout hammered in with steel tool and steel hammer. For through-bolt holes, coordinate the dry pack dense grout application with the vinyl plug.

C. Location for Use of Various Types of Nonshrink Grout. As shown and specified herein before.

D. Horizontal Construction Joints in Reinforced Concrete Walls.

1. Use positive measuring device such as a bucket or other device that will contain only enough sand-cement grout, specified herein before, for depositing in one place in the wall to ensure that portion of the form does not receive too much grout. Limit grout placement to 2-inch maximum thickness.

2. Do not deposit grout from pump hoses or large concrete buckets unless inspection windows close to the joint are available to allow visual measurement of grout thickness and means for grout removal are available for removal of excess grout.

3.02 GROUTING MACHINERY FOUNDATIONS:

A. Block out original concrete or finish off a sufficient distance below bottom of machinery base to provide for thickness of grout as shown. Prepare the concrete surface by sandblasting or chipping or by other mechanical means to remove any soft material.

B. Set machinery in position and wedge to proper elevation by steel wedges or use cast-in leveling bolts.

C. Form with watertight forms at least 2 inches higher than the bottom of the plate.

D. Fill space between bottom of machinery base and original concrete pour with fluid non-shrinking type grout as specified and in accordance with manufacturer's demonstration instructions.

3.03 FIELD TESTS:

A. Evaluation and Acceptance of Non-shrink Grout. Provide a flow cure and cube molds with restraining plates onsite. Continue tests during this project as demonstrated by grout manufacturer before grouting began, as follows:

1. Perform flow cone test and bleed tests and make three (2-inch by 2-inch) cubes for each 25 cubic feet of each type of non-shrink grout used. Cube molds shall have restraining caps specified per COE CRD-C-621.

2. On large grouting placements, make three more cubes, one more flow cone test, and more bleed test for each additional 25 cubic feet of non-shrink grout placed.

3. Flow. As specified herein before.

4. Grout with flows outside the specified range shall be rejected.

5. Non-shrink grout cubes shall test equal to or greater than minimum strength as specified.

6. Strength Test Failures. Reject non-shrink grout work and required removal and replacement of grout with material meeting these Specifications with no additional compensation.

7. Perform bleeding test to show that grout does not bleed. Test fails if grout bleeds.

8. Store cubes at 70°F.

9. An independent testing laboratory shall prepare, store, cure, and test cubes per CRD-C621-89.

10. OWNER will pay costs for the independent test laboratory work to prepare, transport, store, cure, and test the strength samples. The contractor shall assist the independent test laboratory staff during this work, with costs included in the lump sum bid.

B. Evaluation and Acceptance of Other Grout. The OWNER will test and evaluate other grout with samples furnished by the CONTRACTOR.

3.04 MANUFACTURER'S SERVICES:

A. Furnish non-shrink grout manufacturer's representative as follows:

1. Qualifications. An authorized and trained representative of the grout manufacturer.

2. Responsibilities.

a. Coordinate demonstrations, training sessions, and other site visits with the CONTRACTOR.

b. Provide and conduct onsite demonstration and training sessions for bleed tests, proper mixing, flow cone measurement, cube testing, placement, and curing for each

category or type of non-shrink grout used and for each use as specified.

c. Coordinate to ensure necessary equipment and materials are available for demonstration.

d. Check non-shrink grouting during the job with enough frequency to write job service report to describe grout application and workmanship in relation to manufacturer's recommendations.

END OF SECTION

_____
(Test Lab Name)

_____
(Address)

_____
(Phone No.)

24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

DESCRIPTION: 24-hour evaluation and analysis of nonshrink grout in accordance with requirements listed herein.

* This evaluation does not supersede any standard ASTM, CRD, or other tests required by specifier to qualify as an approved grout for the project at hand.

OBJECTIVE: To define a standard set of tests that any local certified independent laboratory can perform and complete within a 24-hour period. Costs to run tests will be borne by the manufacturer of the grout to be tested or by whoever requests a substitute for the specified grouts.

SCOPE: Utilize test procedures providing 24-hour results which attempt to duplicate field grouting demands. This evaluation is intended to prove a manufacturer's quality and viability to perform to standards described by specifier.

PRIOR TO TEST: Secure five bags of each grout to be tested:

1. From local dealer/jobber, preferably from ultimate supplier of grout to the job for which grout is specified.
2. All five bags should be of the same lot number.
3. Obtain data/literature pertaining to grout being tested.

<u>ANSWER THE FOLLOWING QUESTIONS CONCERNING GROUT TO BE TESTED FROM LITERATURE/DATA/PRINTING ON BAG:</u>

A. Is all product data and warranty information contained in company literature/data? Yes __ No __

B. Is It Pertinent? Do literature and bag information agree? Yes __ No ___

C. Does the manufacturer warranty the grout in accordance with project specifications? Yes __ No __

D. Does warranty extend beyond grout replacement value and allows participation with contractor in replacing and repairing defective areas? Yes __ No __

E. Are water demands and limits printed on the bag? Yes __ No __

F. Is mixing information printed on the bag? Yes ___ No __

G. Are temperature restrictions printed on the bag? Yes ___ No __

* Disqualification of a grout if one or more NO answers are noted.

GROUT TESTING REQUIREMENTS

A. Bagged Material:

1. List lot numbers _____

2. List expiration date. _____

3. Weigh bags and record weight. _____

Disqualify grout if bag weights have misstated measure ±2 pounds by more than one out of five bags. (Accuracy of weights is required to regulate amount of water used in the mixing since this affects all other properties.)

B. Mixing and Consistency Determination:

1. Mix full bag of grout in a 10-gallon pail.

2. Use an electric drill with a paddle device to mix the grout (a jiffy or jiffler type paddle.)

3. Use maximum water allowed per the water requirements listed in the bag instructions.

4. Mix grout maximum time listed on bag instructions.

5. Using CRD-C611 (flow cone) determine time of mixed grout through the flow cone._____ seconds.

6. Add water needed to attain 20- to 30-second flow per CRD-C611.

7. Record time of grout through cone at new water demand. _____ seconds.

8. Record total water needed to get 20- to 30-second flow.
_____ pounds

9. Record percent of water manufacturer's recommendations.
_____ percent

C. When fluid grout is specified and additional water is required above manufacturer's listed maximum water, CRD-C621 must run at the new water/grout ratio to determine whether this grout passes using the actual water requirements to be fluid. Use this new water/grout ratio on all remaining tests.

D. Bleed Test:

1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures required for each category and at consistency specified for each.

2. Place one can of grout in tub of ice water; leave one can at ambient temperature.

3. Cover top of both cans with a glass or plastic plate to prevent evaporation.

4. Maintain 38 to 42°F temperature with grout placed in ice, maintain ambient temperature for second container, for 1 hour.

5. Visually check for bleed water at 15-minute intervals for 2 hours.

6. Make final observation at 24 hours.

Disqualify grout if it bleeds even a small amount at the temperatures specified for the category intended for use.

E. Extended Time Flow Test (for Category II and III):

1. Leave the grout in the mix can and mix it with the drillmixer every 5 minutes for 20 seconds. Maintain this process for 1 hour at ambient temperatures of 40, 80, and 100°F.

2. Take a CRD-C611 flow cone test of the grout at 20, 40, and 60 minutes and record the flow time.

a. 20 min ____, sec. @ 40°F
b. 40 min ____, sec. @ 40°F
c. 60 min ____, sec. @ 40°F
d. 20 min ____, sec. @ 80°F

e. 40 min ____, sec. @ 80°F

f. 60 min ____, sec. @ 80°F
g. 20 min ____, sec. @ 100°F
h. 40 min ____, sec. @ 100°F
i. 60 min ____, sec. @ 100°F

Disqualify any category grout that will not go through the flow cone with continuous flow after 60 minutes. Disqualify any category grout for high temperature grouting environments that will not go through the flow cone with a continuous flow after 60 minutes at temperature 40, 80, and 100°F.

_____ _____
Qualified Disqualified

F. 24-Hour Strength Test:

1. Using the grout left in the mixing cans per CRD-C621-89 as specified hereinbefore for the mixing and consistency determination test and for the extended time flow test, make a minimum of nine cube samples.

2. Store cubes at 70°F for 24 hours.

3. Record average compressive strength of nine cubes at 24 hours.

Disqualify grout if 24-hour compressive strengths are under 1,000 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are OK for use on the project for the application shown in the specified table.

_____ _____
Signature of Independent Test Lab Personnel Supervising and Certifying these Test and Test Results

Date Test Conducted

SECTION 04061

MORTAR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar and grout for masonry.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for mortar under this Section. Include payment in Lump Sum for building or structure with price breakdown included in Schedule of Values.

2. Refer to Section 01270 - Measurement and Payment and Section 01292- Schedule of Values.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 143 - Standard Testing Method for Slump of Hydraulic Cement Concrete

B. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

C. ASTM C 150 - Standard Specification for Portland Cement.

D. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.

E. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

F. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout.

G. ASTM C 476 - Standard Specification for Grout for Masonry.

H. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

I. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Include design mix, indicate Property Method used, required environmental conditions, and admixture limitations.

C. Samples: Submit two ribbons of each mortar color, illustrating color and color range.

D. Submit test reports under provisions of Section 01450 - Contractor's Quality Control.

E. Submit test reports on mortar indicating conformance to ASTM C 270.

F. Submit test reports on grout indicating conformance to ASTM C 476.

G. Submit manufacturer's certificate under provisions of Section 01450 - Contractor's Quality Control, that products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site and store and protect products under provisions of Section 01610 - Basic Product Requirements.

B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperatures to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

1.07 MIX TESTS

A. Test mortar and grout in accordance with Section 01454 - Testing Laboratory Services.

B. Testing of Mortar Mix: Test in accordance with ASTM C 780. Test mortar mix for compressive strength, consistency, mortar aggregate ratio, water content, air content, and splitting tensile strength.

C. Testing of Grout Mix: Test in accordance with ASTM C 109. Test grout mix for compressive strength and slump.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C 150, Type I, white color.

B. Masonry Cement: Not permitted.

C. Mortar Aggregate: ASTM C 144, standard masonry type. Grading and color suitable for type of masonry, one source for entire project. (Not less than 5 percent shall pass No. 100 sieve).

D. Hydrated Lime: ASTM C 207, Type S.

E. Grout Aggregate: ASTM C 404.

F. Water: Clean and potable.

2.02 MORTAR COLOR

A. Mortar Color: Mineral oxide pigment; color; to be selected by Public Works from manufacturer's samples.

2.03 ADMIXTURES

A. Antifreeze: Antifreeze admixtures will not be permitted.

B. Accelerator: Accelerator may be used only with approval of Public Works.

2.04 MORTAR

A. Mortar for Load Bearing Walls and Partitions: ASTM C 270, Type S utilizing Property Method to achieve 1800 psi strength.

B. Mortar for Non-load Bearing Walls and Partitions: ASTM C 270, Type S utilizing the Property Method to achieve 1800 psi strength.

C. Mortar for Masonry Below Grade or in Contact with Earth: ASTM C 270, Type M utilizing the Property Method to achieve 2500 psi strength.

D. Pointing Mortar: ASTM C 270, Type N, using the Property Method to achieve 750 psi strength.

2.05 MORTAR MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 270 to achieve strengths noted in Paragraph 2.04.

B. Add mortar color and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

C. Do not use anti-freeze compounds to lower freezing point of mortar.

D. If water is lost by evaporation, retemper only within 2 hours of mixing.

E. Use mortar within 2 hours after mixing at temperatures of 80 degrees F, or 2 1/2 hours at temperatures under 50 degrees F.

2.06 GROUT

A. Bond Beams, Lintels, and Other Areas to be Grouted Solid: 3000 psi strength at 28 days; 7 to 8 inches slump per ASTM C 143; mixed in accordance with ASTM C 476, Fine Grout.

2.07 GROUT MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 476, Fine Grout.

B. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.

C. Do not use anti-freeze compounds to lower freezing point of grout.

PART 3 EXECUTION

3.01 EXAMINATION

A. Request inspection of spaces to be grouted.

3.02 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

B. Plug clean out holes with masonry units to prevent leakage of grout materials. Brace masonry for wet grout pressure.

3.03 INSTALLATION

A. Install mortar and grout in accordance with manufacturer's instructions.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not displace reinforcement while placing grout.

D. Remove grout spaces of excess mortar.

END OF SECTION

SECTION 04210

BRICK MASONRY FOR UTILITY CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Brick masonry work in utility construction for permanent or temporary installation of below ground structures.

B. Brick masonry in repair and rehabilitation of utility lines and associated structures.

1.02 UNIT PRICES

A. No payment will be made for brick masonry under this Section unless specifically noted in bid documents. Include payment in unit price for applicable utility structure section.

1.03 REFERENCES

A. ASTM C 32 - Specification for Sewer and Manhole Brick (Made from Clay or Shale).

B. ASTM C 55 - Standard Specification for Concrete Building Brick.

C. ASTM C 62 - Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).

D. ASTM C 67 - Methods of Sampling and Testing Brick and Structural Clay Tile.

E. ASTM C 91 - Specification for Masonry Cement.

F. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-In. Cube Specimens).

G. ASTM C 140 - Standard Method of Sampling and Testing Concrete Masonry Units.

H. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal

Procedures.

B. Submit certification from the manufacturer that brick units meet applicable requirements of reference standards.

C. As an alternate to providing certification, submit test results that show brick units meet applicable requirements of reference standards, when tested by an approved independent testing laboratory. Test result submittals shall be at no cost to the City.

1.05 HANDLING AND STORAGE

A. Handle and store brick to prevent damage.

B. Store brick and mortar mix off the ground and in a dry place. Cover mortar mix to protect from weather.

PART 2 PRODUCTS

2.01 CLAY AND SHALE BRICK MASONRY UNITS

A. Manholes and Structures: Use brick units made from clay or shale conforming to requirements of ASTM C 32, Grade MM, either cored or solid. Units shall have the following physical properties:

1. Compressive Strength: 2200 psi minimum for individual brick; 2500 psi average for five bricks.

2. Size: 2-1/4-In. by 7-5/8-In. by 3-5/8-In..

3. Test Procedure: ASTM C 67.

B. Sewer Brick: Use brick units made from clay or shale conforming to requirements of ASTM C 32, Grade SM, either cored or solid. Units shall have the following physical properties:

1. Compressive Strength: 3750 psi minimum for individual brick; 5000 psi average for 5 bricks.

2. Size: 2-1/4-In. by 7-5/8-In. by 3-5/8-In..

3. Test Procedure: ASTM C 67.

2.02 CONCRETE BRICK MASONRY UNITS

A. Manholes and Structures: Conform to requirements of ASTM C 55, grade S-1.

B. Dimensions: 2-1/4" by 7-5/8" by 3-5/8".

2.03 MORTAR

A. Provided mortar conforming to the requirements of Section 4061 - Mortar.

PART 3 EXECUTION

3.01 EXAMINATION

A. Ensure that foundations and other surfaces to support brickwork are at proper grades and elevations. Correct improperly prepared surfaces. Work surfaces and masonry shall be free of dirt, grease, oil, or other harmful materials before starting brick masonry work.

3.02 WEATHER REQUIREMENTS

A. Lay no masonry when temperature of outside air is below 50 F, unless satisfactory means are provided to heat materials and protect work from cold and frost.

B. Maintain mortar at 50 F or above and ensure that mortar will harden without freezing.

3.03 BRICK PLACEMENT

A. Use sewer brick where exposed to flow. Where not exposed to flow, use manhole brick.

B. Lay sewer brick with the 2-1/4-In. by 7-5/8-In. side exposed to flow.

C. Lay manhole bricks so that in every fifth course the long axis of bricks are perpendicular to the long axis of the four preceding courses.

D. Lay curved courses, and courses in different planes, using bonded and keyed construction.

E. Lay brick plumb and true with courses level and uniformly spaced. Adjust the bond of face brick so that no course will terminate with a piece less than one-half length of brick.

F. Dampen brick prior to placement.

G. Where fresh masonry joins partially set or totally set masonry, clean surfaces of set masonry. Remove loose mortar and brick. Wet brick to

obtain the best possible bond.

H. Immediately remove mortar droppings and splashing as work progresses to facilitate final cleaning.

3.04 JOINTS

A. Completely fill joints in brick and other materials with mortar as each course is laid.

B. Make joints in exposed brickwork a uniform 3/8-In. wide, unless otherwise shown on Drawings.

C. When mortar is "thumbprint" hard, tool exposed joints with a round or other suitable jointer that is slightly larger than width of the mortar joint. In tooling, make sure that cracks and crevices are closed.

D. Point holes in exposed masonry. Cut out defective joints and repoint.

3.05 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. A minimum of one set of mortar samples shall be molded for each day's placement as directed by Public Works. Mold three 2-In. cube specimens. One cube will be tested for compressive strength at 7 days and 2 cubes will be tested for compressive strength at 28 days in accordance with ASTM C 109.

C. Each load of bricks delivered to the jobsite shall be tested.

1. Test clay bricks in accordance with ASTM C 167.

2. Test concrete bricks in accordance with ASTM C 140.

END OF SECTION

SECTION 05500

MISCELLANEOUS METALS

PART 1 GENERAL

1.01 SECTION INCLUDEDS:

A. This section covers furnishing and installing miscellaneous metal items. Included are all materials and parts necessary to complete each item, even though such work is not definitely shown or specified.

B. Carefully examine drawings and other sections of specifications for extent of miscellaneous metal work required. All metal work not included under other sections of the specifications shall be furnished and installed under this section.

1.02 MEASUREMENT AND PAYMENT

A. No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item, but shall be considered subsidiary to the particular items of work for which unit prices are required in the proposal.

1.03 REFERENCES

A. American Society of Testing and Materials:

B. ANSI/ASTM B209 – Standard Specification for Aluminum-Alloy Sheet and Plate.

C. ANSI/ASTM B221 –Standard Specification for Aluminum-Alloy Extruded Bar, Rod, Wire, Shape and Tube.

D. ANSI/ASTM B308 – Standard Specification for Aluminum-Alloy Structural Shapes, Rolled or Extruded.

E. ANSI/ASTM A36 – Standard Specification for Structural Steel.

F. ANSI/ASTM A193 – Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.

G. ANSI/ASTM A 307 – Standard Specification for Carbon Steel Externally Treaded Standard Fasteners.

H. American Welding Society: D1.1 – Structural Welding Code – Steel.

I. Aluminum Association: Specifications for Aluminum Structures; Qualifications Standard for Structural Welding of Aluminum.

1.04 SUBMITTALS

A. General. Do not begin fabrication until after submittals have been reviewed by the Engineer.

B. Shop Drawings. Submit six (6) sets of shop drawings on all fabricated and cast items. Indicate thickness, type, grade, class of metal and finish. Show construction details, mark numbers, reinforcement, anchorage and interface relation with adjacent construction. Indicate method for protection of aluminum at contact points with concrete or steel.

C. Manufacturer's Product Data. Submit manufacturer's technical information on the expansion bolts proposed for use by the Contractor. The data shall contain sufficient information to evaluate conformance to specifications and shall include pullout and shear test reports from a certified independent testing laboratory.

D. Field Measurements

Prior to fabrication, take necessary field measurements of previously installed construction so that work will fit properly. Members that do not fit properly must be replaced unless approval for their modifications have been obtained from the Engineer.

E. Qualification of Welders

Welding of miscellaneous metal items must be performed by certified welders. Welders must be qualified by procedures of the American Welding Society, Structural Welding Code, Steel and Aluminum Association, Qualifications Standard for Structural Welding of Aluminum, using procedures, materials and equipment of the type required for the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum

1. Aluminum Shapes.

a. Rolled Shapes. Conform to ANSI/ASTM B308 aluminum alloy 6061.

b. Extruded Shapes. Conform to ANSI/ASTM B221 aluminum alloy 6063.

2. Aluminum Plates. Conform to ANSI/ASTM B209 aluminum alloy 6061.

3. Finishes of Aluminum Members. Aluminum members shall have mill finish.

4. Aluminum surfaces that will be in contact with concrete or steel shall be given a heavy coat of alkali resistant bituminous paint, or other coating recommended by the manufacturer that will provide equivalent protection. The coating shall not be visible in the completed installation.

B. Structural Steel Shape, Plates and Bars

ANSI/ASTM A36.

C. Stainless Steel

Where indicated on the drawings as “stainless steel”, “SS” use stainless steel conforming AISI 31b for non-welded items and AISI Type 316L for welded items. All stainless steel shall have a minimum yield strength of 45,000 psi.

D. Abrasive Cast Aluminum Nosings

1. Provide abrasive cast aluminum nosings for all concrete stairs.

2. Unless otherwise indicated, nosings must be not less than 3 inches from front to back, not less than 5/16 inch thick and shall have a hatched abrasive surface.

3. Nosings shall be stopped 3 inches short of each end of threads. Set nosings at the proper height to finish flush with adjacent concrete surfaces.

4. Set nosings level and straight. Anchor nosings to concrete from underside with clip anchors. Place one clip near each end and stagger slips between at approximately 13 inches apart. Upon completion, clean cement from the surface of nosings. Verify that nosings are firmly anchored in place.

E. Carbon Steel Anchor Bolts

Shall conform to ASTM A307. Provide anchor bolts for all equipment and machinery when anchor bolts are furnished by the manufacturer. Anchor size, length, projection, etc., shall conform to the requirements of the equipment and machinery manufacturer. All anchor bolts shall be hot-dip galvanized. Use templets to accurately position the anchor bolts in the forms.

F. Stainless Steel Bolts

Shall be AISI Type 316 conforming to ASTM A193. Use stainless steel bolts where indicated on the drawings as “stainless steel” or “SS”.

G. Expansion Bolts

1. All expansion bolts shall be stainless steel.

2. All expansion bolts shall have a 4:1 safety factor with a minimum working capacity as follows:

Bolt Size	**7/8”**	**3/4"**	**1/2"**	**3/8”**
Minimum Sheet Strength	5250#	4250#	1650#	625#
Minimum Pullout Strength	5250#	4250#	1300#	1030#
Minimum Embankment	7”	4”	3-1/2”	3-1/2”

3. Provide manufacturer’s technical literature and test reports from an accredited independent testing laboratory showing certified bolt capacities for expansion bolts proposed for use on this project.

H. Galvanized Repair Coating

Carboline Carbo Zinc No. 11; Galv-Weld Products; Galv-Weld Alloy; Koppers, Organic Zinc Coating; or equal.

I. Standard Products

Details and specifications of items for which equivalent standard products are available are considered as respective guides for such items. Standard products will be acceptable subject to approval, provided they vary only in minor details from requirements of drawings and specifications.

J. Fabrication

1. Where practical, fit and assemble items in the shop and deliver to the site ready for installation.

2. Shop connections shall be welded or riveted. Do not use screws or bolts where their use can be avoided; where used, countersink heads, screw up tight and nick threads to prevent loosening. Finish welds and rivets flush and smooth on surfaces that will be exposed after installation. Cope or miter corners.

3. Welding.

   a. Welding of steel items shall conform to the requirements of the American Welding Society Structural Welding Code – Steel.

   b. Welding of aluminum shall conform to the requirements of the American Welding Society of the welding of aluminum and the Aluminum Associations Specifications for Aluminum Structures.

   c. Any welding not governed by the above shall be performed in accordance with best modern practice for strength and durability.

   d. All welds exposed to view in completed work shall be ground down flush and finished smooth. Weld continuously along the entire line of contact.

4. Provide anchors where necessary to fasten miscellaneous metal items securely in place.

5. Carefully form metal work to shape and size, with sharp lines and angles and true curves.

6. Drilling and punching must produce clean true lines.

7. Where tight joints are required, mill to a close fit.

8. Thickness of metals and details shall be of ample strength and thickness.

9. Form joints exposed to weather to exclude water.

10. Provide holes and connections for work of other trades.

11. Galvanizing. Hot-dip galvanize all miscellaneous carbon steel items after fabrication, unless otherwise specified. Items completely embedded in concrete shall not be galvanized. Galvanize in accordance with ASTM A123, A120, A153, A163, A386, or A525, as applicable.

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. Conditions of Surfaces

Prior to installation, inspect surfaces to which miscellaneous metal items will be attached. If the condition of such a surface will adversely affect installation, do not proceed with installation until corrective measures have been taken. Verify that aluminum surfaces that will be in contact with concrete or steel are coated as specified.

B. Installation

1. Accurately set work to established lines and elevations and securely fasten in accordance with approved shop drawings and provisions of this section.

2. All work shall be free from finish scratches, nicks, gouges, dents, concrete splatter, paint or any other foreign matter. Damaged material must be replaced without additional cost to the Owner.

C. Touch Up

1. Touch-up surfaces damaged by welding, cutting, abrasion or from other causes as follows:

a. Painted Surfaces. In accordance with Section 09905, Cleaning and Painting Exposed Piping, Valves and Related Items

b. Galvanized Surfaces. Apply two coats of galvanizing repair coating.

END OF SECTION

SECTION 09905

CLEANING AND PAINTING EXPOSED PIPING, VALVES AND RELATED ITEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work to be performed under this section of the specifications shall comprise the furnishing of all labor, materials and equipment necessary to clean, paint and prepare for service the facilities as specified herein.

B. The term “paint”, as used in this section, means the protective coatings specified. Other paints/coatings may be required in other sections of the specifications. All coatings which will be in contact with potable water or vapor areas shall comply with the American National Standards Institute, Inc./National Sanitation Foundation (ANSI/NSF), Standard 61 and shall be applied in conformance with the manufacturer’s published specifications.

C. Work performed and materials used shall comply with the requirements of the Steel Structure Painting Council’s Vol. No. 1, “Good Painting Practices”, and Vol. 2, “Systems and Specifications”, and these technical specifications. Where a conflict exists between these technical specifications and the Steel Structures Painting Council’s Specifications, these technical specifications govern.

1.02 MEASUREMENT AND PAYMENT

A. No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item, but shall be considered subsidiary to the particular items of work for which unit prices are required in the proposal.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials Specified The materials specified herein under the sections titled “Coating Systems” and “Coating Schedule” are based on Tnemec paint systems acceptable to the Engineer/Owner. Substitutes will be allowed subject to approval of the Owner.

B. Materials Used. Contractor shall submit the materials to be used in accordance with Section 01300 SUBMITTALS.

C. Color for exterior finish coat will be selected by owner.

D. Submittals of Alternate Materials

E. Contractor must provide data proving equality of products and performances at no expense to the Owner. Such data will include manufacturer's data sheets and any specific test results requested by the Engineer/Owner. Test results must be from an independent testing laboratory.

F. Contractor shall provide proof of acceptable performance for a minimum of five (5) years in similar applications.

G. Contractor shall provide five (5) names of cities or users with contacts, addresses and telephone numbers for references.

2.02 MANUFACTURER'S INSTRUCTIONS

A. The manufacturer's published instructions for use in specifying and applying the manufacturer's proposed paint, if different from or not included on their product data sheet, shall be submitted to the Engineer. Paint shall not be delivered to the job site before review of the manufacturer's instructions by the Engineer. The manufacturer's published instructions must meet the following requirements:

1. The instructions must have been written and published by the manufacturer for the purpose and with the intent of giving complete instruction for the use and application of the proposed paint in the locality and for the conditions for which the paint is specified or shown to be applied under this contract.

2. All limitations, precautions and requirements that may adversely affect the paint; that may cause unsatisfactory results after the painting application; or that may cause the paint not to serve the purpose for which it was intended shall be clearly and completely stated in the instructions. These limitations and requirements shall include, but not be limited to, the following:

a. Surface preparation.
b. Methods of application.
c. Thickness of each coat.
d. Drying time of each coat, including primer.
e. Drying time of final coat before placing in service.
f. Time allowed between coats.
g. Primer required to be used.
h. Thinner and use of thinner.

i. Weather limitations during and after application with emphasis on dry time which may affect appearance and uniformity of color (temperature and humidity).

j. Physical properties of paint, including percent solids content by volume and weight per unit surface per dry mil thickness.

k. Equipment settings (air cap, fluid tip, equipment pressure settings, etc.)

2.03 DELIVERY AND STORAGE

A. All paint shall be delivered to the job in original containers marked with the name of the manufacturer and the specification number or formula of the paint contained therein. The paint shall not show excessive settling in a freshly opened can, and shall be easily redispersed with a paddle to a smooth, homogenous state. The paint shall show no curdling, livering, caking or color separation, and shall be free from lumps or skins. The paint shall dry to a smooth, uniform finish, free from roughness, grit, unevenness and other surface imperfections.

B. Store materials in an approved location. Keep the storage clean and repair any damage done. Remove oily rags, waste, or other fire hazards from buildings each night; take adequate precautions to avoid damage by fire. Place cloths and waste material which might constitute a fire hazard in metal containers or destroy at the end of each day. Maintain all coatings in compliance with local, state and federal regulations. Do not allow water based coatings to freeze. Maintain all other coatings within temperature ranges approved by manufacturer.

2.04 MAINTENANCE MATERIAL

A. At the end of the project, the Contractor shall turn over to the Owner a gallon of each type and color of paint, primer, thinner, or other coatings used in the field painting. The material shall be delivered in unopened labeled cans, just as it comes form the factory. If the manufacturer does not package the material in gallon cans, and in the case of special colors, the materials shall be delivered in new gallon containers, properly closed with typed labels indicating brand, type, color, etc.

B. Where multiple component materials are used, the Contractor shall supply an unopened kit of the necessary materials in the manufacturer’s smallest standard packaging size (i.e., a 2-component epoxy with a 1:1 mix ratio would require a 1-gallon can of resin and a 1-gallon can of curing agent). The manufacturer’s literature describing the materials and giving directions for their use shall be furnished in three bound copies. A typewritten inventory shall be furnished at the time of delivery.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Steel Surfaces.

1. Touch-ups. Damaged areas on steel surfaces shall be required using the same materials used originally or compatible equal approved by the Engineer.
2. Exterior. All such steel surfaces shall be prepared in accordance with the latest revision of Steel Structures Painting Council Surface Preparation Specifications.
3. Steel surfaces include carbon steel, cast iron and ductile iron.

B. Galvanized Surfaces. All galvanized surfaces which are to be painted shall be prepared in accordance with the latest revision of Steel Structures Painting Council definition SSPC-SP1-82, Solvent Cleaning, or as specified by the coatings manufacturer.

C. Masonry Surfaces. All masonry surfaces shall be free of all oil, dirt, form release agents, laitance, effloresecence or other deleterious matter. Cleaning may include acid etching and/or abrasive grit blasting.

D. Wood Surfaces. All wood surfaces shall be free of all dirt, oil, grease or other foreign matter. Surfaces shall be dry and free of gouges and sanded smooth. All knots shall be cleaned and sealed in accordance with the manufacturer's recommendations.

E. Dry Walls. All dry wall surfaces shall be dry and free of all dirt, oil and other contaminants. All nail heads must be counter sunk and sealed.

F. Aged Existing Coatings. Aged existing coatings which are to be topcoated after power washing, sweep blasting and/or spot blasting and priming shall be tested for adhesion prior to topcoating using a crosshatch test method according to ASTM D-3359.

G. Plastic Surfaces. All plastic piping or reinforced fiber-glass plastic surfaces to be coated shall be lightly sanded and/or solvent cleaned prior to coating in accordance with manufacturer's recommendation.

H. Other Surfaces. Other surfaces may require surface preparation in accordance with the following Steel Structures Painting Council definitions:

1. SSPC-SP1 Solvent Cleaning
2. SSPC-SP2 Hand Tool Cleaning
3. SSPC-SP3 Power Tool Cleaning

4. SSPC-SP5 White Metal Blast Cleaning
5. SSPC-SP6 Commercial Blast Cleaning
6. SSPC-SP7 Brush-Off Blast Cleaning
7. SSPC-SP8 Pickling
8. SSPC-SP10 Near White Blast Cleaning
9. SSPC-SP11 Power Tool Cleaning to Bare Metal

I. Abrasive Materials. All abrasive materials shall be graded and free of all contaminants. The grade shall be of such size to achieve an anchor pattern or surface profile required by the coating manufacturer.

J. Equipment. All abrasive blast and other equipment shall be equipped with, but not limited to, the following:

1. Hose coupling safety devices
2. Electrical grounding devices
3. Appropriate moisture traps and filters
4. Fresh air hoods for all blasters
5. “Dead Man” switches on all blast hoses

K. All Cleaned Surfaces. All cleaned surfaces which are subject to rusting or contamination shall be painted the same day they are cleaned. If for any reason the surfaces cannot be coated the same day, they must be re-cleaned by methods approved by the Engineer or his representative, inspected and brought up to standard prior to coating application.

L. Other Conditions.

1. Grease and/or oil contamination cannot be removed by abrasive cleaning. All such contamination shall be removed in accordance with SSPC-SP-1, Solvent Cleaning, prior to manual, power tool or abrasive blast cleaning.

2. Care must be taken not to allow detrimental solvent or detergent residues to remain on surfaces to be coated.

3. Where abrasive blast cleaning will not remove or properly prepare metal surfaces, hand and/or power tool cleaning shall be used to handle such conditions.

4. Shop Primed Surfaces. Where metalwork, equipment, valves and the like are shop primed, the primer used must be compatible with the coating system to be applied in the filed. Full information shall be furnished regarding the shop prime coat and, if not compatible with succeeding coats, in the opinion of the Owner’s Representative, the

shop prime coat shall be removed as directed by the coatings manufacturer or the Owner's Representative.

5. Unknown or Noncompatible Materials. Items coated with an unknown paint system, or a primer or system which is not compatible with the specified system, shall be cleaned by an acceptable method and recoated with the specified coating system at the job site. When cleaning is not feasible, the Contractor shall notify the Engineer and request permission to apply a barrier coat over the unknown or non-compatible material. The proposed barrier coat must be recommended in writing by the paint system manufacturer and is subject to review by the Engineer. Following application of the barrier coat, if permitted, the specified coating system shall be applied. Minimum dry film thickness shall be increased an amount equal to the barrier coat and unknown or non compatible coats.

M. Surface Profile. The surface profile (anchor pattern) shall be as recommended by the coatings manufacturer and determined by visual comparators or profile tape.

3.02 APPLICATION

A. General

1. All materials shall be applied in accordance with the coatings manufacturer's recommendations and shall be performed in a workmanlike manner by experienced workmen.

2. All surfaces shall be free of dust and other contaminants prior to coating.

3. All application equipment shall be electrically grounded as required and have clean operating gauges, moisture traps, etc.

4. Manufacturer's Representative. The coating manufacturer shall be responsible, through an authorized representative, to provide technical assistance to the paint contractor as needed.

B. Environmental Conditions. Coatings shall not be applied under the following conditions unless specifically authorized in writing by the coatings manufacturer and/or Engineer.

1. Surface temperature of the surface to be coated is at/or below 50°F or is expected to fall to or below 50°F within four hours of coating application.

2. Surface temperature of the surface to be coated is at 135°F or above.

3. The relative humidity is 85% or greater.

4. The temperature is within 5°F of the dew point or is expected to drop to that level within 8 hours of application.

5. Surfaces to be coated are wet or damp.

6. Misting rain, snow, fog or dust-laden air.

7. Excessive wind velocity (exterior).

C. System Compatibility. Unless specifically approved by the Engineer/Owner, coatings from different manufactures may not be mixed within a coating system.

D. Safety Precautions.

1. Contractor shall comply with applicable regulations set forth in the Code of Federal Regulations, OSHA Health and Safety Standards 29CFR-1926/1910, latest edition.

2. Contractor shall comply with the applicable regulations set forth in the TAC Title 30 Chapter 101, General Rules, Paragraph 101.4, concerning Nuisance Emissions and Chapter 111, Control of Air Pollution From Visible Emissions and Particulate Matter, Abrasive Blasting Of Water Storage Tanks Performed By Portable Operations, Paragraphs 111.131 through 111.139.

3. Surrounding equipment, fixtures, etc., shall be protected with drop cloths or other appropriate shielding from drops and overspray. Surfaces which are contaminated shall be cleaned and, if necessary, repainted.

4. The Contractor must provide adequate forced air ventilation, while cleaning and painting. Ventilation shall be adequate to remove fumes, preventing injury to workmen or possible accumulation of volatile gases.

5. Proper and adequate illumination equipment shall be provided including explosion proof equipment where required by the Engineer/Owner.

6. Fresh air hoods shall be provided for painters and inspectors as necessary.

7. Warnings. Display caution signs in necessary areas advising of spray painting and warning against open flames.

E. Special Instructions.

1. In multi-coat systems, each coat shall be a different color to verify adequate coverage. However, the cost just prior to the finish coat, as necessary, may be tinted to approximately the same color as the finish coat to ensure adequate hiding.

2. The use of spray-painting equipment which diffuses paint and compressed air or generates paint fog or permits paint spray to become air-borne will not be permitted. Paint shall not be applied when conditions are such that windblown driftage, insects or moisture can collect on the freshly applied paints.

3. The Contractor shall take all necessary precautions to prevent paint from being scattered or windblown during application and shall be responsible for any and all damages due to settlement of paint on dwellings, structures, vehicles, or property in the vicinity of the work.

4. All cloths and cotton waste which might constitute a fire hazard shall be placed in covered metal containers or destroyed at the end of each work day. Upon completion of the work, all scaffolding, and containers shall be removed from the site or destroyed in a manner approved by the Engineer. Paint spots, oil or stains upon adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

5. The sequence to be followed in painting shall be such that a minimum of damage to finished coatings will result.

F. Curing. Special consideration shall be given to drying and curing times of coatings as recommended by the coatings manufacturer.

3.03 INSPECTION/QUALITY ASSURANCE

A. Materials, Equipment and Coating System. All materials and equipment used in the accomplishment of the job are subject to inspection at any time by the Engineer and/or Construction Observer. All steps in the coating system shall be subject to inspection prior to progressing to succeeding steps. Phases of inspection shall include but not be limited to:

1. Pre-cleaning (surface preparation) survey of facilities to painted.

2. During surface preparation and prior to coating inspection.

3. During and immediately after each coating application.

B. General Conditions for Inspection. Contractor shall not move or remove scaffolding, ladders or other fixtures necessary to provide proper inspection until such action has been approved by Construction Observer.

C. Surface Preparation.

1. Metal surfaces shall be inspected using the latest revision of the Steel Structures Painting Council definitions and approved equipment and procedures. NACE (National Association of Corrosion Engineers) definitions and standards and SSPC-Vis1-89 may also be used at the discretion of the Engineer.

2. Other surfaces shall be inspected in accordance with these specifications as previously defined.

D. Dry Film Thickness Measurements.

1. Ferrous metal surfaces will be checked using an acceptable magnetic pull-off (Type 1) or single fixed probe (Type II) gauge as described in SSPC-PA-2.

2. Non-magnetic surfaces will be checked with an approved wet film gauge.

3. Where non-magnetic surfaces are too irregular to be checked with a wet film gauge, estimated film thicknesses will be arrived at using coating manufacturer's published coverage rates and uneven color or shadowy appearance.

E. Methods and Procedures. Unless otherwise specified, inspection procedures shall be in accordance with the latest revision of AWWA Specification D-102, Section 8.

F. Finish. All finish coats shall be inspected visually and shall be free of all unsightly sags, runs, bubbles, drips, waves, laps, unnecessary brush marks, overspray, environmental contaminants or other physical defects and shall be uniform in color.

G. Inspection Tools. The inspection tools which may be used without precluding the use of others are shown below:

a. Wet Film Gauge

b. Magnetic Pull-Off (Type I) or Single Probe (Type II) Gauge

c. National Bureau of Standards Calibration Chips for Type I DFT Gauge

d. Plastic Shims for calibrating Type II DFT Gauge

e. Low voltage, wet sponge pinhole/holiday detector such as a Tinker & Rasor Model M-1

f. SSPC or ISO Pictorial Standards

g. Profile Comparators (Clemtex-K-Tator)

h. Replica Tape for measuring anchor pattern (surface profile)

i. Blast Hose Needle Gauge

j. Blast Nozzle Aperture Gauge

k. Sling Psychrometer with Charts

l. Inspection Mirror

m. Surface Temperature (thermometers)

3.04 REPORTING/RECORDS

A. Inspections. All inspections shall be recorded and shall include, not be limited to, the following information:

1. Date

2. Time of Day

3. Job Identification

4. Engineer

5. Contractor and Sub-Contractor

6. Specified Coating System

7. Specified Surface Preparation

8. Coatings Manufacturer and Product Batch Numbers being used

9. Weather Conditions –

   i. Temperature (Air and Surface)

   ii. Humidity/Dew Point

   iii. Wind Velocity/Direction

10. Remarks/Results of Inspection

B. Daily Work Reports. The Contractor will be required to furnish to the Engineer or Owner's Representative copies of daily work reports. These work reports shall include, but not be limited to, the following information:

   1. Date – Start up and shut down time

   2. Names of personnel on job

   3. Tasks performed by individual personnel with time frame required to perform tasks

   4. Equipment being utilized

   5. Materials and quantities used

   6. Weather conditions and time taken (minimum twice daily) –

      i. Temperature (air and surface)

      ii. Humidity/dew point

      iii. Wind velocity/direction

   7. Work accomplished with remarks concerning equipment breakdown and/or any job irregularities.

3.05 REPAIRS OF DEFECTS

A. Exterior and Cosmetic Surfaces. Exterior and/or cosmetic surfaces will be repaired using the same material and matching color.

B. Low Film Thicknesses. Inspections discovering low firm thicknesses at a significant number of inspection points may require additional coat(s) of material at the discretion of the Engineer/Owner or Construction Observer. These additional coats will be at the Contractor's expense.

3.06 GUARANTEE

A. The Contractor shall guarantee the job against defective materials and workmanship for a period of one (1) year from the date of acceptance of the job by the Owner. On or about the eleventh month of service, the facilities will be cleaned and inspected. At that time, all rust spots and other defects in the coating system shall be repaired as necessary at the Contractor's expense. Repairs will be made within thirty (30) days after written notice by the Engineer/Owner.

3.07 COATINGS SYSTEMS AND SCHEDULE

A. **Valves.** Shall include Check Valves, Gate Valves, Butterfly Valves, Surge Relief Valves, Pump Control Valves, and appurtenances to be located above ground or in a vault.

Coating System.
Shop Coat: Tnemec Series 20-1211 Red Pota-Pox applied at 3.0-5.0 dry mils
Second Coat: Tnemec Series 140-1255 Beige Pota-Pox Plus applied at 6.0-8.0 dry mils
Third Coat: Tnemec Series 140-AA90 White Pota-Pox Plus applied at 6.0-8.0 dry mils
Total dry film thickness shall be 15.0 mils. minimum and 21.0 mils. maximum.

B. **Steel Pipes**. Shall include Steel Pipe, Steel Fittings, Dresser Couplings, Steel Spool Pieces and appurtenances to be located above ground or in a vault.

Coating System.
Prime Coat: Tnemec Series 140 Pota-Pox Plus applied at 6.0-8.0 mils.
Finish Coat: Tnemec Series 75 Endura-Shield applied at 3.0-5.0 mils
Total dry film thickness shall be 9.0 mils. minimum and 12.0 maximum.

C. **Pumps**. Shall include all pumps with Suction and Discharge Flanges, Sole Plates and appurtenances to be located above ground.

Coating System.
Shop Coat: Tnemec Series 20-1211 Red Pota-Pox applied at 3.0-5.0 dry mils
Second Coat: Tnemec Series 140-1255 Beige Pota-Pox Plus applied at 6.0-8.0 dry mils
Third Coat: Tnemec Series 140-AA90 White Pota-Pox Plus applied at 6.0-8.0 dry mils

Total dry film thickness shall be 15.0 mils. minimum and 21.0 mils. maximum.

D. **Pipe Supports.** Shall include all steel pipe supports and appurtenances to be located above ground or in a vault.

Coating System.

Shop Coat: Tnemec Series 20-1211 Red Pota-Pox applied at 3.0-5.0 dry mils

Second Coat: Tnemec Series 140-1255 Beige Pota-Pox Plus applied at 6.0-8.0 dry mils

Third Coat: Tnemec Series 140-AA90 White Pota-Pox Plus applied at 6.0-8.0 dry mils

Total dry film thickness shall be 15.0 mils. minimum and 21.0 mils. maximum.

3.08 TOTAL DRY THICKNESS

A. For all exterior surfaces: Total dry film thickness of the new coating system shall be as specified above per SSPC dry film thickness inspection standards.

B. Engineer shall verify and record the average dry film thickness of the existing coating system, if applicable, (per SSPC average dry film thickness standards) prior to application of the new coating system. The total dry film thickness of the existing system and newly applied system shall be the sum of the two.

END OF SECTION