SPECIFICATIONS

FOR

5 HOMESTEAD AVENUE FORCE MAIN EXTENSION

PROJECT

KEY LARGO WASTEWATER TREATMENT DISTRICT

103355 OVERSEAS HWY
KEY LARGO, FL 33037

WEC Job No: 03105.082

by

THE WEILER ENGINEERING CORPORATION

6805 OVERSEAS HIGHWAY
MARATHON, FLORIDA

OCTOBER 2023

THIS IS TO CERTIFY THAT THE ENCLOSED ENGINEERING SPECIFICATIONS WERE PREPARED BY ME OR UNDER MY RESPONSIBLE CHARGE.

Edward R. Castle
State of Florida, License No. 58571 This item has been
digitally signed and sealed by Edward R. Castle, P.E. on the date indicated here.
010/18/2023
Printed copies of this document are not considered signed and sealed and the digital signature must be verified on any electronic copies.

Edward R. Castle

Digitally signed by Edward R. Castle
Date: 2023.10.18 15:02:27 -04'00'

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10/18/2023

Date

TECHNICAL SPECIFICATIONS
FOR
5 HOMESTEAD AVENUE FORCE MAIN EXTENSION

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DIVISION 1: GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions (if included), and other Division 1 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Contract description.

B. Work by others.

C. Contractor use of Site.

D. Work sequence.

E. Owner occupancy.

1.3 CONTRACT DESCRIPTION

Contract Type: Stipulated Price as described in the Agreement.

1.4 WORK BY OTHERS

A. Work under these Contracts includes: Any portion of work described in the plans as work to be performed by others. Unless specifically stated, it is implied that all work shown is the responsibility of the contractor.

1.5 CONTRACTS

The strategy for the completion of the project consists of the contracts as follows:

A. Scope of work

The Key Largo Water Treatment District is performing a tap on the existing 8" force main and installing a 3" plug valve and box on the proposed 3" force main. The project includes the procurement and installation of approximately 180 linear feet of 3" DR 11 HDPE or SDR 21 PVC force main to the property line located at 5 Homestead Avenue in Key Largo, Florida. Also included in the scope of work is a 3" plug valve and capped 3" stub at the property line and all final restoration work including sod, gravel, and final asphalt restoration per the Construction Plans and Contract Documents.

B. Project Overview

The contractor shall be responsible for the following items:

i. Mobilization
This portion of the project includes mobilization to the job site as detailed in the plans and specifications.

ii. Bonds & Insurance
This portion of the project includes bonds and insurance for the project as detailed in the plans and specifications.

iii. 8" X 3" Tap

This portion of the project includes a tap of the existing 8" force main and installation of a plug valve as detailed in the plans and specifications.

iv. 3" HDPE DR 11 or SDR 21 PVC Force Main

This portion of the project includes installation of approximately 180 linear feet of 3" DR 11 HDPE or SDR 21 PVC piping running to the property line for 5 Homestead Avenue in Key Largo, Florida as detailed in the plans and specifications.

v. 3" Plug Valve and Capped Stub at Property Line

This portion of the project includes installation of a 3" plug valve and box with a 3" capped stub at the property line for 5 Homestead Avenue in Key Largo, Florida as detailed in the plans and specifications.

vi. Restoration

This portion of the project includes restoration of the sod and gravel in the right-of-way area in all disturbed locations of the job site as detailed in the plans and specifications and is measured in square yards.

vii. Asphalt Restoration

This portion of the project includes restoration of the asphalt as detailed in the plans and specifications and is measured in square yards.

viii. Final As-Builts
This portion of the project includes providing final signed and sealed as-built record drawings as detailed in the plans and specifications.

For a more detailed description of the project please refer to the project drawings in Appendix G and the project specifications in Appendix H.

1.6 CONTRACTOR USE OF SITE

A. Limit use of Site to allow:
   1. Owner occupancy.
   2. Work by Others.

B. The existing facility must remain in operation while new construction is in progress.

C. The Contractor shall coordinate his Work with the Owner so that construction will not usually restrain or hinder operation of the existing facility or Others working on site. If, at any time, any portion of the facility must be taken out of service in order for the Work to proceed, the Contractor must obtain approval from the Owner as to the date, time and length of time that portion of the facility is out of service. Approval must be gained ten (10) days in advance of the necessary outage. The Owner shall exercise good faith in attempting to accommodate the Contractor's desire to take existing facility out of service. However, the Owner retains sole discretion as to the scheduling of any such service outage and, provided the Owner does not act arbitrarily or in bad faith, the Contractor waives any claim to additional contract time or additional contract price as a result of the Owner's decisions regarding scheduling of service outages.

D. Connections to the existing facilities or alteration of existing facilities will be made at times when the piping or facility involved is not in use or at times, established by the Owner, when use of the piping or facility can be conveniently interrupted for the period of time needed to make the connection or alteration.

E. After having coordinated his work with the Owner, the Contractor shall notify the Engineer of the Contractor's desired time, time limits and methods of each connection or alteration and have approval of the Engineer before any work is undertaken on the connections or alterations.

F. Before any on-site roadway or facilities are blocked off the Owner shall be contacted to coordinate operations for the facility. Off-site roadway work is to be coordinated with the local governing agency and (or) the Florida Department of Transportation, as appropriate.

G. The existing facility shall remain the property of the Owner, unless reused by written authorization. This includes all parts, equipment, materials and appurtenances. At the discretion of the Owner, this contract shall demolish and dispose of all demolished materials in an approved and environmentally-safe manner onto Contractor supplied trucks for removal. Or at the Owner's discretion, assist in salvage of the equipment by disassembly and loading onto Owner supplied trucks for removal.

1.7 WORK SEQUENCE

Construct Work in phases to accommodate Owner's occupancy requirements and Work by Others during the construction period, coordinate construction schedule and operations with Owner.

1.8 OWNER OCCUPANCY

C. Owner intends to occupy the existing portion of the facility to maintain operations.

D. Owner will occupy the Site during the entire period of construction for the conducting of normal operations.

E. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

F. Schedule the Work to accommodate Owner occupancy.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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SECTION 01051

GRADES, LINES, AND LEVELS

PART 1 GENERAL

1.1 DESCRIPTION

A. All work under this contract shall be constructed in accordance with the lines and grades on the plans or as given by the Engineer or Owner. The full responsibility for holding to alignment and grade shall rest upon the Contractor.

B. The Contractor shall have a certified Land Surveyor set a bench mark for use as a control point in the project. The Contractor will be responsible for setting all grade stakes, slope stakes, offsets from these points, and all other layout and staking.

C. The Contractor shall safeguard all points, stakes, grade marks, bench marks, and monuments established on the work, shall bear the cost of re-establishing same if disturbed, and shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect such established points, stakes, and marks.

END OF SECTION

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. Permits and Responsibilities

The Contractor shall, without additional expense to the Owner, be responsible for obtaining any necessary licenses and permits, and for complying with any applicable Federal, State and municipal laws, Codes and regulations, in connection with the execution of the Work. He shall take proper safety and health precautions to protect the Work, the workers, the public and the property of others. He shall also be responsible for all materials delivered and work performed until completion and acceptance of the Work, except for any completed unit of construction thereof which may heretofore have been accepted.

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SECTION 01080

APPLICABLE CODES AND STANDARDS

1.1 GENERAL

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

1. Pressure Piping and Tubing
   - ANSI American National Standards Institute
   - API American Petroleum Institute
   - ASME American Society of Mechanical Engineers
   - AWWA American Water Works Association
   - NSF National Sanitation Foundation
2. Materials
   - AASHTO American Association of State Highway and Transportation Officials
   - ANSI American National Standards Institute
   - ASTM American Society for Testing and Materials
3. Painting and Surface Preparation
   - NACE National Association of Corrosion Engineers
   - SSPC Steel Structures Painting Council
4. Gear Reducers and Bearings
   - AFBMA Anti-Friction Bearing Manufacturers Association
   - AGMA American Gear Manufacturers Association
5. Ventilating Fans
   - AMCA Air Moving and Conditioning Association
   - PFMA Power Fan Manufacturers Association
6. Electrical and Instrumentation
   - EIA Electronic Industries Association
   - IEEE Institute of Electrical and Electronic Engineers
   - IPC Institute of Printed Circuits
   - IPCEA Insulated Power Cable Engineers Association
   - ISA Instrument Society of America
   - NEMA National Electrical Manufacturers Association
   - NFPA National Fire Protection Association
   - UL Underwriter's Laboratories
7. Aluminum Structures
   - AA Aluminum Association
   - AAMA Architectural Aluminum Manufacturers Association
8. Steel Structures
   - AISC American Institute of Steel Construction
9. Concrete Structures
   - ACI American Concrete Institute
10. Welding
    - ASME American Society of Mechanical Engineers
    - AWS American Welding Society

11. Safety
    - OSHA Occupational Safety and Health Act
12. General Building Construction
    - FM Factory Mutual Fire Insurance Company
    - NFPA National Fire Protection Association
    - SBC SBCC Standard Building Code
13. Ductwork and Sheet Metal Work
    - SMACNA Sheet Metal and Air Conditioning Contractors National Association
14. Plumbing
    - AGA American Gas Association
    - NSF National Sanitation Foundation
    - PDI Plumbing Drainage Institute
    - SPC SBCC Standard Plumbing Code
15. Refrigeration, Heating, and Air Conditioning
    - ARI American Refrigeration Institute
    - ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers
16. Pressure Vessels
    - ASME American Society of Mechanical Engineers

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

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

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SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.1 SCOPE

A. This section specifies administrative and procedural requirements for project meetings including but not limited to:
   1. Pre-Construction Conference.
   2. Progress Meetings.

B. Construction schedules are specified in another Division 1 section.

1.2 RELATED DOCUMENTS

Drawings, general conditions of the Contract, including General Provisions and other Division 1 specification sections, apply to this section.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Attend and participate in a pre-construction conference and organizational meeting at the project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees - The Owner, Engineer and their consultants, the contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda - Discuss items of significance that could affect progress including such topics as:
   1. Tentative construction schedule.
   2. Critical work sequencing.
   3. Designation of responsible personnel.
   4. Procedures for processing field decisions and Change Orders.
   5. Procedures for processing Applications for Payment.
   6. Distribution of Contract Documents.
   7. Submittal of shop drawings, product data and samples.
   8. Preparation of record documents.
   9. Use of the premises.
   10. Office, work and storage areas.
   11. Equipment deliveries and priorities.
   12. Safety procedures.
   13. First aid.
   14. Security.

15. Housekeeping.
16. Working hours.

1.4 PROGRESS MEETINGS

A. Conduct progress meetings at the project site at regularly scheduled intervals but not less than monthly. Notify the Owner and Engineer of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees - In addition to representatives of the Owner and Engineer, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda - Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the project.
   1. Contractor's Construction Schedule
      a. Review progress since the last meeting.
      b. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule.
      c. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so.
      d. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.
   2. Contractor's Submittal Schedule.
      a. Review progress since the last meeting.
      b. Determine where each activity is in relation to the Contractor's Submittal Schedule, whether on time or ahead or behind schedule.
      c. Determine how submittals behind schedule will be expedited; secure commitments from parties involved to do so.
      d. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.
   3. Review the present and future needs of each entity present, including such items as:
      a. Interface requirements.
      b. Time.
      c. Sequences.
      d. Deliveries.
      e. Off-site fabrication problems.
      f. Access.
      g. Site utilization.
      h. Temporary facilities and services.
      i. Hours of work.
      j. Hazards and risks.
      k. Housekeeping.
      l. Quality and work standards.
      m. Change Orders.
      n. Documentation of information for payment requests.

D. Reporting - No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

E. Schedule Updating - Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

END OF SECTION

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SECTION 01270

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Payment for all Work done in compliance with the Contract Documents, inclusive of furnishing all manpower, equipment, materials, and performance of all operations relative to construction of this project, will be made under Pay Items listed herein. Work for which there is not a Pay Item will be considered incidental to the Contract and no additional compensation will be allowed.

B. The CONTRACTOR shall take no advantage of any apparent error or omission in the Drawings or Specifications, and the OWNER'S REPRESENTATIVE shall be permitted to make corrections and interpretations as may be deemed necessary, for fulfillment of the intent of the Contract Documents.

C. The OWNER'S REPRESENTATIVE will make measurements and determinations, as necessary, to classify the work within pay items and determine the quantities for pay purposes.

D. Where pay item numbers are shown on the bid form, they generally follow FDOT pay item number formatting; however, they are only provided to use them for pay application purposes. FDOT pay item descriptions do not apply; utilize the descriptions on the bid form and within this section to determine the work associated with each pay item.

PART 2 PAY ITEMS

2.01 Mobilization

A. Mobilization/Demobilization includes preparatory work and operations in mobilizing for beginning work on the project, including, but not limited to those operations necessary for the movement of personnel, equipment, preconstruction video, supplies, and incidentals to the project site and to remove all personnel, equipment, excess supplies, and incidentals for the project site at the completion of the Work. Mobilization/Demobilization shall not exceed 5% of the total Bid.

B. Unit of measure is Lump Sum

2.02 Bonds, Insurance, Taxes, Etc.

A. Bonds, insurance, and taxes as required by the General Conditions.

B. Unit of measure is Lump Sum

2.03 8”X3” Tap with 3” Plug Valve and Box

A. Work includes the tap of the 8” force main and installation of a 3” plug valve and box on the proposed 3” force main pipe as shown on the Contract Plans and Contract Documents.

B. Unit of measure is LS.

2.04 3” HDPE Force Main Pipe

A. Work includes the procurement and installation of approximately 180 linear feet of 3” DR 11 HDPE or SDR 21 PVC piping to the property line for 5 Homestead Avenue, Key Largo, Florida as shown on the Contract Plans and Contract Documents.

B. Unit of measure is LF.

2.05 3” Plug valve and Stub

A. Work includes the procurement and installation of a 3” plug valve and box on the force main and 3” cap at the property line for 5 Homestead Avenue in Key Largo, Florida as shown on the Contract Plans and Contract Documents.

B. Unit of measure is LS.

2.06 Sod and Gravel Restoration

A. Work includes the sod and stone restoration for the disturbed right-of-way areas located at 5 Homestead Avenue in Key Largo, Florida as shown on the Contract Plans and Contract Documents.

B. Unit of measure is SY.

2.07 Asphalt Restoration

C. Work includes the procurement and installation of asphalt for the disturbed asphalt areas at 5 Homestead Avenue in Key Largo, Florida as shown on the Contract Plans and Contract Documents.

D. Unit of measure is SY.

2.08 Signed and Sealed As-Built Record Drawings

E. Work includes providing signed and sealed final as-built record drawings signed and sealed by a licensed surveyor or Professional Engineer for the force main piping installation at 5 Homestead Avenue in Key Largo, Florida as shown on the Contract Plans and Contract Documents.

F. Unit of measure is LS.

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 EQUIPMENT DELIVERY AND CONSTRUCTION SCHEDULE

Not later than 10 consecutive calendar days after the issuance of the "Notice to Proceed," the Contractor shall submit to the Engineer for review a detailed schedule of major equipment delivery and installation and general construction operations, indicating the sequence of the work, the estimated dates of starting each task, and the estimated time of completion of each task. The schedule shall be broken down with respect to individual structures and facilities, indicating when existing structures or equipment would be taken out of service (if applicable). The form and content of the schedule shall be satisfactory to the Engineer.

1.2 SHOP DRAWINGS AND PRODUCT DATA

A. The Contractor shall submit to the Engineer for review and approval complete drawings and engineering data for all equipment, materials, and products to be incorporated into the work. Shop drawings and engineering data shall be provided, and the Engineer's review will be conducted in accordance with the requirements of this section. Shop drawings and/or engineering data, as appropriate, shall be submitted for the following items, including, but not limited to all items shown on the Drawings or specified in these Specifications.

B. Engineering data submitted for items of mechanical and electrical equipment shall include the following, as applicable:

1. Complete material specifications and bill of materials
2. Performance specifications and curves and operating characteristics
3. Shipping, handling, storage, and protection instructions
4. Anchorage and embedment details
5. Assembly, erection, and installation diagrams and instructions
6. Assembled weight
7. Welding qualifications and qualification procedures
8. Factory test data and results
9. Specifications on surface preparation and shop finishes
10. Manufacturers' product bulletins or catalog sheets.

C. Shop drawings and engineering data for equipment supplied as a pre-engineered or pre-assembled system shall include complete shop drawings and engineering data on each component of that system. In all cases, the information provided shall be sufficient to determine if the material or product conforms to the requirements of the Specifications.

D. Shop drawings and engineering data shall be prepared by the original equipment vendors or fabricators, as applicable. Purchase specifications by the Contractor or his Supplier shall not be acceptable as a substitute for actual vendor drawings and data.

E. Shop drawings for motor control circuits shall include complete schematic control diagrams, wiring diagrams, and terminal connection diagrams. Each control step in the schematic control diagrams shall include a step identification number and a brief functional description. Each control step shall be cross-referenced with other control steps with which it connects using the appropriate step identification numbers.

F. Shop drawings for instrument and control systems shall include, where applicable, complete process and instrumentation diagrams in ISA format, detailed loop diagrams, program descriptions, logic diagrams, wiring diagrams, and terminal connection diagrams.

G. All controls shall be completely described as to function: normally-open, normally-closed, fail open, fail closed, direct acting, reverse acting, air-to-open, air-to-close, etc. Settings of all pressure and temperature switches, relief valves, rupture discs, pressure regulators, etc., shall be noted.

H. All shop drawings shall include a legend or other suitable means to identify all symbols and abbreviations used on the drawing. Where an accepted, industry-wide drafting standard or symbol has been established for a particular item, information depicted on the shop drawings shall conform to that standard.

I. Shop drawings shall be dimensioned using the U.S. standard unit of measurement (feet and/or inches). Size of drawing shall not exceed 24 by 36 inches. All scaled drawings and details shall have the scale clearly noted on the drawing or detail. All information shall be clear and legible.

J. Each shop drawing and each item of engineering data shall contain a cover sheet that bears the Contractor's approved stamp indicating that the Contractor has reviewed the drawing or data for conformance with the Contract Documents. The cover sheet shall also allow room for the Engineer's review stamp, which is approximately $3^1/_2$ inches wide by $4^1/_2$ inches high.

K. All design calculations and drawings for foundations and footings, sheeting and shoring, and concrete formwork shall bear the signed and dated stamp of a licensed professional engineer.

1.3 MISCELLANEOUS SUBMITTALS

A. The Contractor shall submit to the Engineer miscellaneous information, procedures, test data, samples, etc., in the manner and at the time specified in these Specifications and Contract Documents. Miscellaneous submittals shall include, but not be limited to, the following:
   1. Procedures for handling and disposing of sewage flows during construction.
   2. Factory test data and results where specified for specific items of equipment.
   3. Schedule of values.
   4. Preliminary Operation and Maintenance Manuals.
   5. Final Operation and Maintenance Manuals.
   6. Samples of wire and cable, casework, window glazing details, concrete masonry units, quarry tile, roofing and flashing, push-on PVC joint details, and other items as specified in the Specifications.
   7. Preliminary concrete mix design reports.

8. Satisfactory written evidence in the form of laboratory or mill test reports indicating that all cement, aggregate, masonry, structural steel, fencing, castings, steel reinforcement, conduit, pipe, grout, grass seed and other items incorporated into the work are in compliance with the requirements of these Specifications.
9. Project record documents.
10. Copies of original invoices of all equipment delivered to the site.
11. When requested, analysis and design data on concrete formwork and sheeting and shoring.
12. Drawings and details of erosion and sediment control structures.
13. Written evidence of equipment warranties.

1.4 SAMPLES

At the Engineer's request, the Contractor shall furnish certified samples of materials utilized in the fabrication or production of equipment, materials, and products supplied under these Contract Documents. Cost of all such samples shall be borne by the Contractor. The samples will be tested by a qualified independent testing laboratory selected by the Owner to determine if the mechanical and chemical properties of the materials supplied are in accordance with the requirements of these Specifications and Contract Documents. The Owner shall pay for the laboratory testing of material samples provided by the Contractor. The Contractor shall pay for all retests made necessary by the failure of materials to conform to the requirements of these Specifications and Contract Documents.

1.5 PROGRESS RECORD PICTURES

A. The Contractor shall furnish three copies of 5- by 7-inch pictures as a record of progress made each month. These pictures will be a minimum of six each month taken from locations designated by the Resident Project Representative to best show progress of Project and will include the following:
   1. Project name
   2. Owner's name and contract number
   3. Contractor's name and job number
   4. View and general description of what photograph shows
   5. Date photograph was taken.

   Prints shall be submitted to the Engineer in a regular photograph mailer marked "Photographs-Do Not Bend." Cost of photographs shall be included in the lump sum price bid and no separate payment will be made therefore.

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SECTION 01310

CONSTRUCTION SCHEDULING

PART 1 GENERAL

1.1 DESCRIPTION

The Contractor shall submit to the Engineer for approval construction planning, scheduling, and cost value documentation pertaining to the Project as detailed herein and shall update same throughout Project as required.

1.2 SUBMITTAL PROCEDURES

A. Within ten (10) working days of Notice to Proceed, the Contractor shall submit to the Engineer for approval the products required by this section of the Specifications.

B. Within five (5) working days following receipt of same the Engineer shall arrange for a meeting with the Contractor so as to familiarize the Engineer with the Contractor's proposed construction plans and schedules.

C. Within five (5) working days following the Engineer's review the Contractor shall resubmit a corrected copy of those documents requiring revision.

D. Within five (5) working days following his receipt of the adequately revised documents the Engineer will approve same for use on the Project.

E. Once approved, the Contractor shall submit four (4) copies of the construction scheduling documents to the Engineer for use on the Project.

F. The Contractor shall update the work schedules at least monthly and indicate those activities whose completion dates are in jeopardy because of activities behind schedule.

G. The Owner may require the Contractor to modify any portions of the work schedule that become infeasible because of "activities behind schedule" or for any other valid reason. Any such modification will be at the Contractor's expense unless the modification is required to accommodate schedule revisions required by the Owner.

H. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule.

1.3 CHANGE ORDERS

Upon approval of a Change Order by the Owner the approved change shall be reflected in the next submittal by the Contractor.

PART 2 PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULE

A. The Construction Progress Schedule shall be submitted in form satisfactory to the Owner showing the following items of each of the various subdivisions of work required under the Contract Document, Specifications, and Drawings.
   1. Activity Number
   2. Activity Description
   3. Estimated Activity Duration (Work Days)
   4. Activity Start Date (Calendar Dated)
   5. Activity Finish Date (Calendar Dated)
   6. Activity Cost

B. The anticipated amount of each monthly payment that will become due the Contractor in accordance with the progress schedule shall be included thereon. This anticipated monthly payment schedule shall distribute the costs of the project more or less evenly over the scheduled project life in a manner acceptable to the Owner and compatible with the Owner's funding arrangements for the project. Resubmittal will be required until anticipated monthly payment schedule is acceptable to Owner. For this Project, substantial variation from this schedule of payments will not be permitted.

C. Schedule Format
   1. The project schedule shall be in the form of a Gantt chart depicting the anticipated critical path for construction activities or equipment delivery. A critical path bubble type schedule shall also be acceptable.
   2. The schedule shall be updated monthly or at appropriate intervals that are consistent with the actual project schedule. Shall at any time the actual project work be found to deviate more than 45 days from the schedule, the schedule shall be modified to reflect the actual and newly project work completion date.

D. The Contractor shall prepare a separate schedule of anticipate partial payments (commonly referred to as an “S” curve) in lieu of a combined payment and work activity schedule.

2.2 TEMPORARY FACILITIES AND CONSTRUCTION TRAFFIC MANAGEMENT

A. The contractor shall provide a schematic plan for routing of construction traffic. The plan must minimize the impact to regular landfill and road department traffic. Where an unavoidable conflict exists, a plan for management of that conflict must be provided.

B. Along with the Construction Progress Schedule, a list of required temporary facilities, including but not limited to temporary haul roads and temporary soil erosion sedimentation control shall be provided.

2.3 ESTIMATES

A. The Detailed Estimates shall give a complete and satisfactory breakdown of the Contract amount.

B. Periodic Itemized Estimates shall detail work done for the purpose of tabulating partial payments thereon.

2.4 PROJECT INFORMATION

A. Each tabulation shall be prefaced with the following summary data:
   1. Project Name
   2. Contractor
   3. Type of Tabulation (Initial or Updated with revision number)
   4. Project Duration
   5. Project Scheduled Completion Date
   6. Effective or Starting Date of the Schedule
   7. If an updated (revised) schedule, the new project completion date and project status

2.5 SCHEDULE MONITORING

A. When specifically requested by the Engineer, the Contractor shall submit to the Engineer a revised schedule for those activities that remain to occur.

B. The revised schedule shall be submitted in the form, sequence, and of the number of copies requested for the initial schedule.

2.6 COST VALUE FOR ACTIVITIES

A. The Contractor shall establish and submit a cost value for each activity in his progress schedule and estimates so that monthly partial payments to the Contractor can be calculated on the basis of work in place.

B. Subject to the provisions for "Partial Payments" in the General Conditions of the Contract all cost value reports for network activities shall be based upon the close of books as of the 20th day of each month, and the submittal of such costs value for activities shall be submitted to the Engineer for review and approval not later than the 25th day of each month.

C. Wherever in the Supplementary General Provisions it is provided that payments will be allowed for materials delivered to the site but not yet incorporated in the work, subject to the terms and conditions specified in the General Conditions, separate pay items shall be established for furnishing and installation of such items.

D. Costs of materials delivered to the site but not yet incorporated into the work shall be included as a separate pay item and shall not be included in the cost value of the installation activity for such materials.

END OF SECTION

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SECTION 01315

PRECONSTRUCTION VIDEO

PART 1 GENERAL

1.1 DESCRIPTION

Provide continuous color audio-video recording along the entire length of all proposed work prior to construction to serve as a record of pre-construction conditions. Supplement audio-video recordings with color photographs (digital) for areas which require details not ascertainable on the recording.

1.2 QUALIFICATIONS

The preconstruction audio-video recording shall be of professional quality that will clearly log an accurate visual description of existing conditions. Any portion of the recording not acceptable for the determination of the existing conditions shall be re-recorded at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

The total audio-video recording system and the procedures employed in its use shall be such as to produce a finished product that will fulfill the technical requirements of the project. The video portion of the recording shall produce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of picture imperfection. The audio portion of the recording shall produce the commentary of the camera operator with proper volume, clarity, and be free from distortion.

2.2 CAMERA

1. Resolution: Minimum 1080p HD resolution, with preference for 4K support.

2. Color Profile: Must support at least sRGB color profile. Adobe RGB and RAW format support is desirable.

3. Zoom Capabilities: Must have an optical zoom function with a minimum of 10x zoom.

4. Image Stabilization: Must have built-in image stabilization.

5. Auto-Focus: Must include an auto-focus system with face detection and tracking capabilities.

6. Low Light Performance: Must perform well in low light conditions and possess high dynamic range capabilities.

7. Frame Rate: Minimum required frame rate is 30fps, with preference for 60fps.

8. Durability: Must be built with durability in mind, with bonus for dust and water resistance.

9. Battery Life: Must have a battery life adequate for extended shooting sessions. The capability to swap batteries is required.

10. Storage: Must support external storage, with a minimum support for 128GB SD

2.3 RECORDER

1. Recording Format: Must support MP4 format, due to its wide compatibility and good balance between file size and quality. Support for MOV format can also be useful for Mac users.

2. Codec: Must support modern efficient codecs such as H.264 or H.265 (HEVC) for video, and AAC or MP3 for audio.

3. Bit Rate: The minimum video bit rate should be 50 Mbps when recording in 1080p and a minimum of 100 Mbps when recording in 4K.

4. Audio: Must have a built-in microphone for audio capture, with an option to attach an external microphone for better audio quality. Should support stereo audio recording.

5. Frame Rate: Must support multiple frame rates including 24fps, 30fps, and 60fps to cater to different shooting requirements.

6. Recording Modes: Must support continuous recording, with automatic file splitting when the file size reaches 4GB.

2.4 VIDEO PLAYBACK COMPATIBILITY

1. Supported Formats: The playback device or software must support MP4 and MOV formats.

2. Supported Codecs: Must be compatible with H.264 or H.265 (HEVC) for video, and AAC or MP3 for audio.

3. Resolution: Must support playback in at least 1080p resolution, with preference for devices or software that support 4K playback.

4. Frame Rate: Should be capable of playing videos at various frame rates, such as 24fps, 30fps, and 60fps.

5. Bit Rate: The playback system should be capable of handling high bit rate videos. Ideally, it should support videos with bit rates of 50 Mbps for 1080p and 100 Mbps for 4K.

6. Sound: Must support stereo audio playback.

PART 3 EXECUTION

3.1 GENERAL

A. The recordings shall contain coverage of all surface features located within the construction's zone of influence. The construction's zone of influence shall be defined (1) as the area within the permanent and temporary easements or right- of-way, and areas adjacent to these areas which may be affected by routine construction operations, and (2) by the direction of the

Owner. The surface features within the construction's zone of influence shall include, but not be limited to, all roadways, pavements, curbs, driveways, ponds, sidewalks, culverts, headwalls, retaining walls, buildings, landscaping, trees, shrubbery, and fences. Of particular concern shall be the existence of any faults, fractures, or defects. Recorded coverage shall be limited to one side of the street at any one time and shall include all surface conditions located within the zone of influence of construction supported by appropriate audio description.

B. The recording of each video segment shall be a simultaneously recorded with the audio recording. This audio recording, exclusively containing the commentary of the camera operator, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the feature being shown in the video portion of the recording. The audio recording also shall be free from any conversations between the camera operator and any other production technicians.

C. All videos shall be permanently labeled and shall be properly identified by project title, number, and date of recording.

D. Each video shall have a log of that media's contents. The log shall describe the various segments of coverage contained on that video tape in terms of the names of streets or easements, coverage beginning and end, directions of coverage, and video unit counter/segment numbers.

3.2 RECORDING SCHEDULE

A. The recording shall be performed prior to the placement of any construction materials or equipment on the proposed construction site.

B. The Contractor shall coordinate the recording with the construction schedule so that those portions of the construction that will be completed first will be recorded first. The recording company shall deliver the videos to the Owner upon their completion. Upon delivery of the videos, transfer of ownership of those videos shall be made to the Owner.

3.3 VISIBILITY

All recordings shall be performed during times of good visibility. No recording shall be done during periods of significant precipitation, mist, or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subject, and to produce bright, sharp video recordings of those subjects. No taping shall be performed when more than 10% of the area to be taped contains debris or obstructions unless otherwise authorized by the Engineer.

3.4 CONTINUITY OF COVERAGE

A. In order to increase the continuity of the coverage, the coverage shall consist of a single, continuous, unedited recording which begins at one end of a particular construction area. However, where coverage is required in areas not accessible by conventional wheeled vehicles and smooth transport of the recording system is not possible, such coverage shall consist of an organized, interrelated sequence of recordings at various positions along that proposed construction area (e.g., wooded easement area).

B. The average rate of travel during a particular segment of coverage (e.g., coverage of one side of the street) shall be directly proportional to the number, size, and value of the surface features within that construction area's zone of influence.

3.5 CAMERA HEIGHT AND STABILITY

When conventional wheeled vehicles are used as conveyances for the recording system, the distance between the camera lens and the ground shall not be less than 10 feet. The camera shall be firmly mounted, such that transport of the camera during the recording process will not cause any unsteady picture.

3.6 CAMERA CONTROL

Camera pan, tilt, zoom-in, and zoom-out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during video tape playback. In addition, all other camera and recording system controls, such as lens, focus, and aperture, video level, pedestal, chroma, white balance, and electrical focus, shall be properly controlled or adjusted to maximize recorded picture quality.

3.6 VIEWER ORIENTATION TECHNIQUES

The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views and visual displays of all visible house and building addresses shall be utilized. In easements where the proposed construction location will not be readily apparent in the video tape viewer, highly visible yellow flags shall be placed in such a fashion as to clearly indicate the proposed centerline of construction.

3.7 AREAS TO BE RECORDED

A. The Contractor shall be able to televise and record areas with paved roads, along easements, through parks, lawns, open fields, and inside buildings. When recording on private property, the Contractor shall give the Owner sufficient prior notice of such entry so that property owners may be advised of, and their permission obtained for, the work.

B. At no time shall the Contractor be allowed to use any electrical circuits within private property building structure. All recording shall be done during regular business hours, unless otherwise specified by the private property owner or the Engineer. The Contractor shall enter and leave private property in a professional and orderly, workmanlike manner.

END OF SECTION

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SECTION 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.1 DESCRIPTION AND REQUIREMENTS

A. Type of Submittals: This Section of the specifications describes the procedures for submittals such as shop drawings, product data, samples and miscellaneous work-related submittals. It does not include the submittals required for administrative work.

B. Submittal Contents: The submittal contents required are specified in each section.

C. Definitions: Submittals are categorized as follows:
   1. Shop Drawings
      a. Shop drawings shall include technical data, drawings, diagrams, performance curves, schedules, templates, patterns, reports, calculation, instructions, measurements and similar information as applicable to specific item for which the shop drawing is prepared.
      b. Provide newly prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note those based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawing copies without appropriate final “Action” markings by the Engineer to be used in connection with the Work.
   2. Product Data
      a. Product data includes standard printed information on materials, products and systems, not specially prepared for this project, other than the designation of selections from among available choices printed therein.
      b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements that have been checked, and special coordination requirements.
   3. Samples
      a. Samples include both fabricated and unfabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or (where indicated) for more detailed testing and analysis.
      b. Provide units identical with final condition of proposed materials or products for the work. Include “range” samples (not less than three units) where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is

required. Prepare samples to match the Engineer’s sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture, and “kind” by the Engineer. Engineer will not “test” samples (except as otherwise indicated) for other requirements, which are the exclusive responsibility of the Contractor.

4. Miscellaneous submittals related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.2 GENERAL SUBMITTAL REQUIREMENTS

A. Scheduling: Where appropriate in various required administrative submittals (listings of products, manufacturers, supplier and subcontractors, and in job progress schedule), show principal work-related submittal requirements and time schedules for coordination and integration of submittal activity with related work in each instance.

B. Coordination of Submittal Times: Prepare and transmit each submittal to the Engineer sufficiently in advance of performing related work or other applicable activities, so the installation will not be delayed or improperly sequenced by processing times, including non-approval and resubmittal (if required). Coordinate with other submittals, testing, purchasing, delivery and similar sequenced activities. No extension of time will be authorized because of Contractor's failure to transmit submittals to the Engineer sufficiently in advance of the work.

C. Sequencing Requirements: As applicable in each instance, do not proceed with a unit of work until submittal procedures have been sequenced with related units of work, in a manner which will ensure that the action will not need to be later modified or rescinded by reason of a subsequent submittal which should have been processed earlier or concurrently for coordination.

D. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and provide space for the Engineer's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through the Contractor's office will be returned "without action."

E. Transmittal Identification

1. Number transmittals in sequence for each Division of the Specifications. The number after the dash indicates the Section of the Specifications, and the number before the dash is the sequence number of the transmittal (1-15140 would be the first transmittal applicable to Section 15140 of the Specifications, 2-15140 would be the second transmittal for Section 15140, etc.)

2. Identify resubmittals with a letter of the alphabet following the original number, using A for the first resubmittal, B for the second resubmittal, etc. A resubmittal affecting transmittal 1-15140 would then be numbered 1A-15140. The number 1-15140 would then be entered in the space "Previous Transmittal Number," which is left blank except on resubmittals.

1.3 SPECIFIC CATEGORY REQUIREMENTS

A. Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal.
   1. Submittals shall contain:
   2. The date of submittal and the dates of any previous submittals.
   3. The project title:
   4. Contract No. ____.
   5. Contractor:
   6. Supplier:
   7. Manufacturer:
   8. Identification of the product, with the Specification Section number and equipment tag numbers.
   9. Field dimensions, clearly identified as such.
   10. Relation to adjacent or critical features of the work or materials.
   11. Applicable standards, such as ASTM or Federal Specification numbers.
   12. Notification to the Engineer in writing, at time of submittal, of any deviations on the submittals from requirements of the Contract Documents.
   13. Identification of revisions on resubmittals.
   14. An 8-inch x 3-inch blank space for Contractor and Engineer stamps.
   15. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
   16. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of item for which review is requested crossed out.

1.4 ROUTING OF SUBMITTALS

Submittals and routine correspondence shall be routed as follows:
1. Supplier to Contractor (through representative if applicable) for preliminary check.
2. Contractor to Consulting Engineer for general review or comment.
3. Consulting Engineer to Contractor.
4. Contractor to Supplier.

1.5 SUBMITTAL COPIES REQUIRED

A. Shop Drawings, Product Data, and Miscellaneous Submittals
   All submittals marked “A” or “B” will be distributed as follows:
   1. For Engineer 1 copy
   2. For Contractor 3 copies

3. For Field Inspection Office 1 copy
4. For Owner 1 copy
Total *6 copies*

B. To the above number, additional copies may be added as required by the Contractor.

C. The Engineer will mark all copies of each shop drawing. One will be retained in the Engineer's office, one sent to the Field Inspection office, one will be retained for the Owner and the remaining copies sent to the Contractor for his records and distribution.

D. For non-approval items, such as parts lists and operation or maintenance manuals, 5 copies are required, unless specified otherwise:

S 2 copies
1. Owner 3 copies
2. Engineer 2 copies
3. Contractor 4 copies
Total *9 copies*

E. Samples: In accordance with the QA/QC Plan, the contractor shall furnish certified samples of materials utilized in the fabrication or production of equipment, materials, and products supplied under these Contract Documents. Cost of all such samples shall be borne by the Contractor. The samples will be tested by a qualified independent testing laboratory selected by the Owner to determine if the mechanical and chemical properties of the materials supplied are in accordance with the requirements of these Specifications and Contract Documents. The owner shall pay for the laboratory testing of material samples provided by the Contractor. The Contractor shall pay for (at no additional cost to the Owner) all retests made necessary by the failure of materials to conform to the requirements of these Specifications and Contract Documents.

1.6 REVIEW OF SUBMITTALS

A. Review Time: Allow a minimum of two weeks for the Engineer’s initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the work, and therefore the work would be expedited if processing time could be foreshortened.

B. Engineer’s Action
1. Final Unrestricted Release
2. Work may proceed, provided it complies with contract documents, when submittal is returned with the following:
3. Marking: “A” – No Exceptions Taken.
4. Final-But-Restricted Release
5. Work may proceed, provided it complies with notations and corrections on submittal and with contract documents, when submittal is returned with the following:
6. Marking: “B” – Exceptions Taken as Noted.
7. Returned for Resubmittal

8. Do not proceed with Work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the work.
   - Marking: “C” – Revise and resubmit.
   - Marking: “D” – Rejected; Does Not Comply with Project Requirements. Only two copies of items marked “C” or “D” will be reviewed and marked. One copy will be retained and the other copy with all remaining unmarked copies will be returned to the contractor for resubmittal.

1.7 SPECIAL SUBMITTAL REQUIREMENTS FOR EQUIPMENT, COATINGS, SEALANTS, AND OTHER SYSTEMS

The Contractor is directed to Section 01300, Submittals, for special certifications or other requirements associated with Shop Drawings and submittals.

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SECTION 01510

TEMPORARY UTILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

All permissions and requirements of the Work described in this section shall not be special or extra pay items but included in the lump sum project cost.

1.2 TEMPORARY LIGHT

The Contractor shall provide temporary lighting facilities for the proper prosecution and inspection of the work. These facilities shall be installed and maintained by the Contractor and shall be located in such a manner as to result in the least interference with work upon the project site and existing facilities.

1.3 TEMPORARY POWER

The Contractor shall provide temporary power facilities required for the proper prosecution and inspection of the work. These facilities shall be installed and maintained by the Contractor, and shall be located in such a manner as to result in the least interference with work upon the project site and existing facilities. Temporary power facilities shall remain in place after completion of construction until final acceptance of the work. After final acceptance of the work, the Contractor shall remove temporary power facilities.

1.4 TEMPORARY WATER

The Contractor shall make the necessary arrangements for securing and transporting all water required in the construction, including water required for mixing of concrete, sprinkling, testing, flushing, flooding or jetting and including any temporary pipeline or equipment which may be necessary to make use of such water.

1.5 POTABLE WATER

The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, Engineers and the Owner who are associated with the work progress.

1.6 TEMPORARY TELEPHONE SERVICE

Provide telephone service, for the duration of the project, at the Contractor's field office.

1.7 SANITARY FACILITIES

The Contractor will provide sufficient sanitary facilities in proximity to the areas of work for his employees and those employees of his subcontractors. The Contractor will be responsible for continual maintenance and servicing of these facilities.

1.8 FIRST AID FACILITIES

The Contractor shall maintain, at a well-known place at the job site, all articles necessary for giving first aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees) who may be injured on the job site. In no case, shall employees be permitted to work at a job site before the employer has made a standing arrangement (verified in writing to the Owner) for removal of injured persons to a hospital or a doctor's care.

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SECTION 01540

JOB SECURITY

PART 1 GENERAL

1.1 BARRICADES, LIGHT, AND WATCHMEN

A. The Contractor shall furnish and erect such barricades, fences, lights, and danger signals, shall provide such watchmen, and shall provide such other precautionary measures for the protection of persons or property and of the work as are necessary. Barricades shall be painted in a color that will be visible at night. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any work under construction. The Contractor shall furnish watchmen in sufficient numbers to protect the work.

B. The Contractor will be held responsible for all damage to the work due to failure of barricades, signs, lights, and watchmen to protect it and whenever evidence is found of such damage, the Contractor shall immediately remove the damaged portion and replace it at his cost and expense. The Contractor's responsibility for maintenance of barricades, signs, and lights and for providing watchmen shall not cease until the project has been accepted by Owner.

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SECTION 01562

DUST CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

Limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control. Means or methods other than potable water shall be submitted to the Engineer for approval.

1.2 PROTECTION OF ADJACENT PROPERTY

The bidders shall visit the site and note the buildings, landscaping, roads, parking areas and other facilities near the work site that may be damaged by their operations. Contractor shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from his operations.

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SECTION 01590

FIELD OFFICES

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide field offices and sheds as described below.

B. Field offices shall be at sites designated by Owner.

PART 2 PRODUCTS

2.1 CONTRACTOR'S FIELD OFFICE

A. Provide a field office with the following minimum facilities:
   1. A standard prefabricated or mobile unit suitably anchored for bad weather.
   2. An individual direct line telephone service, with answering machine.
   3. Adequate lighting, heating, air conditioning, and ventilation.
   4. Sufficient filing cabinets for the project record documents.

2.2 ENGINEER'S FIELD OFFICE

A. The General Contractor shall provide and maintain a 900-square-foot-minimum field office for the exclusive use of the Engineer.

B. Field Office shall be a separate weather-tight structure with:
   1. Suitable anchoring for bad weather.
   2. Electric service, electric heat, air conditioning (central unit preferred), and lights.
   3. Two outside doors with locks.
   4. At least four windows, suitably arranged for ventilation.
   5. Toilet facilities and continuous supply of potable water.
   6. At least one wall receptacle on each wall.
   7. An individual direct line telephone service with one fixed touch tone telephone, answering machine, fax machine, and outdoor bell.
   8. A minimum of one office, conference room with room to seat six, general entrance, and work/file area.
   9. Contractor shall pay all charges for the following utilities:
      a. Heating
      b. Electricity
      c. Water
      d. Telephone - local service only. (The Contractor shall not pay charges for long distance calls made by the Engineer.)

C. Contractor shall provide the following:
   1. One flat-top office desk ($2^1/_2$ by $4^1/_2$ feet) with drawers on each end and four desk chairs on rollers.
   2. One 3- by 6-foot drawing table.
   3. Six straight chairs.
   4. Two four-drawer, steel filing cabinets with lock and keys.
   5. Two large metal wastebaskets.
   6. One plan rack.
   7. Wall-mounted fire extinguisher, as required.
   8. One water cooler/bottled water.
   9. One copier (electrostatic) capable of $8^1/_2$ by 11 to 14-inch copies. Contractor shall be responsible for maintaining copier throughout contract period. Unit may be "all-in-one" printer/copier.
   10. Continuous inventory of expendable supplies for above items.

D. Field office shall be ready for occupancy before beginning any construction, unless an extension of time is granted by the Engineer.

2.3 SHEDS

A. Storage platforms and sheds shall be provided for materials that require protection from the weather.

B. Sheds shall be substantially constructed.

END OF SECTION

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SECTION 01620

TRANSPORTATION AND HANDLING

1.1 GENERAL

The Contractor shall provide transportation of all equipment, materials, and products furnished under these Contract Documents to the site of the work. In addition, Contractor shall provide preparation for shipment and storage, unloading, handling and rehandling, short-term storage, extended storage, storage facilities, maintenance and protection during storage, preparation for installation, and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the work.

1.2 TRANSPORTATION

A. All equipment shall be suitably boxed, crated, or otherwise protected during transportation.

B. All equipment shall be shipped and delivered in the largest assembled sections practical or permitted by carrier regulations to minimize the number of field connections.

C. The Contractor shall be responsible for ensuring that the equipment is assembled and transported in such a manner so as to clear buildings, power lines, bridges, and similar structures encountered during shipment or delivery to the site of the work.

D. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.

E. Small items and appurtenances such as gauges, valves, switches, instruments, and probes which could be damaged during shipment shall be removed from the equipment prior to shipment and packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

F. Temporary shipping braces and supports shall be painted orange or yellow for easy identification.

1.3 HANDLING

A. All equipment, materials, and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation. All equipment, materials, and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds

that permitted by standard industry practice. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

C. Under no circumstances shall equipment or products such as pipe, structural steel, casting, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

D. Items such as nonmetallic pipe, nonmetallic conduit, flagpoles, and lighting poles shall be handled using nonmetallic slings or straps.

END OF SECTION

SECTION 01630

PRODUCT SELECTION AND SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES: Product selection and substitution procedures.

1.2 PRODUCT SELECTION

A. Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, new at the time of installation.

B. To the fullest extent possible, provide products of the same kind from a single source.

C. Compatibility among product options is required. Where more than one choice is available as options during product selection, select an option which is compatible with other products and materials already selected.

D. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.

E. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

F. Where Contract Documents are at variance with specific manufacturer's details and installation procedures, contact Engineer for resolution prior to start of work.

1.3 SUBSTITUTIONS

A. The intent of these Specifications is to provide the Owner with a quality facility without discouraging competitive bidding. Substitutions may be submitted and will be evaluated as specified herein.

B. The Contractor’s bid includes products named in the Specifications The Contractor may propose a substitute product under and in accordance with the Standard General Conditions (Section 00700) Subsection 6.05, as modified by the Supplementary Conditions (Section 00800.) Unless the Engineer expressly approves the substitute, the Contractor must provide a product named in the Specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01640

STORAGE AND PROTECTION

PART 1 GENERAL

1.1 GENERAL

A. Equipment shall be received, inspected, unloaded, handled, stored, maintained, and protected by the Contractor in a suitable location on or off site, if necessary, until such time as installation is required.

B. Storage and protection of Contractor-furnished equipment shall be in strict conformance with the requirements in the Contract Documents.

1.2 STORAGE

A. The Contractor shall be responsible for providing satisfactory storage facilities which are acceptable to the Engineer. In the event that satisfactory facilities cannot be provided on-site, satisfactory warehouse facilities, acceptable to the Engineer, will be provided by the Contractor for such time until the equipment, materials, and products can be accommodated at the site.

B. Equipment, materials, and products which are stored in a satisfactory warehouse acceptable to the Engineer will be eligible for progress payments as though they had been delivered to the job site.

C. The Contractor shall be responsible for the maintenance and protection of all equipment, materials, and products placed in storage and shall bear all costs of storage, preparation for transportation, transportation, rehandling, and preparation for installation.

D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel, and sheet construction products shall be stored with one end elevated to facilitate drainage.

E. Unless otherwise permitted in writing by the Engineer, building products and materials such as cement, grout, plaster, gypsum-board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block, and structural tile may be stored outdoors under a properly secured waterproof covering.

F. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

1.3 EXTENDED STORAGE

In the event that certain items of major equipment such as air compressors, pumps, and mechanical aerators have to be stored for an extended period of time, Contractor shall provide satisfactory long-term storage facilities that are acceptable to the Engineer. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, and lubricants, exercising necessary or recommended directive by the manufacturer to properly maintain and protect the equipment during the period of extended storage.

END OF SECTION

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SECTION 01710

CLEANUP

PART 1 GENERAL

1.1 DESCRIPTION

This section covers general cleaning which the Contractor shall be required to perform both during construction and before final acceptance of the project unless otherwise shown on the Drawings or specified elsewhere in these Specifications.

1.2 HAZARD CONTROL

A. The Contractor shall store volatile wastes in covered metal containers and remove from premises daily.

B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.

C. Burning or burying rubbish and waste materials on the site shall not be allowed.

D. Disposal of volatile wastes into sanitary or storm sewers shall not be allowed.

1.3 DISPOSAL OF SURPLUS MATERIALS

A. Unless otherwise shown on the Drawings, specified or directed, the Contractor shall dispose of all surplus materials and equipment from demolition, legally off the site, and shall provide his own suitable, off-site spoil area, or on a site designated by the Owner.

B. The Owner shall have the opportunity to inspect any equipment or materials removed prior to disposal by the Contractor. If said equipment and/or materials are determined to be salvageable by the Owner, the Contractor shall transport said equipment and material to a building or area designated by the Owner.

1.4 FINAL CLEANING

The Contractor shall:

A. Schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.

B. Employ experienced workmen or professional cleaners for final cleaning.

C. Broom clean paved surfaces; rake clean other surfaces of grounds.

D. Upon completion of the work, Contractor shall remove from the site all plant, material, tools and equipment belonging to him, and leave the site with an appearance acceptable to the Engineer.

E. Restoration of Landscape Damage - Any landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. The Engineer will decide what method of restoration shall be used.

F. Post-Construction Cleanup or Obliteration - Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction.

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SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 MAINTENANCE OF DOCUMENTS

A. The Contractor shall maintain accurate record documents related to the furnishing and installation of equipment, materials, and products at the site of the project during the course of the work.

B. The Contractor shall maintain at the project site one record copy of each of the following:
1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to Contract Documents
7. Field Test Records

Project record documents shall be stored in suitable files and racks in a location satisfactory to the Engineer and shall be available at all times to the Engineer. The documents shall be maintained in a clean, dry, legible condition and shall not be used for construction purposes.

1.2 RECORDING

The Contractor shall label each document "Project Record" in one-inch high letters. Record documents shall be kept current and work shall not be permanently concealed until the required information has been recorded.

A. Contract Drawings: Contractor shall legibly mark to record the actual construction on the project record set of prints of the Contract Drawings, including reviewed shop drawings, the following:
1. Horizontal and vertical location of underground utilities and appurtenances referenced to mean sea level or permanent surface improvements.
2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
3. Field changes of dimension and detail, including elevations of foundations.
4. Changes made by change order or field order.
5. Details not on original Drawings.

After completion of the work, the Contractor shall prepare a reproducible set of project record drawings by drafting: (1) the notations made on the record set of prints onto a set of reverse reading, translucent, matte finish, mylar reproducible Drawings furnished by the Owner; and (2) notations on the record set of shop drawings onto translucent, matte finish, mylar reproducible (ozalid process) copies of the reviewed shop drawings furnished by the Contractor.

B. Specifications and Addenda: The Contractor shall legibly mark up each section to record:
   1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed
   2. Changes made by change order or field order
   3. Other matters not originally specified.

1.3 SUBMITTAL

At the completion of the work and prior to final acceptance by the Owner, the Contractor shall deliver the Project Record Documents to the Engineer. The Project Record Documents shall be acceptable to the Engineer before final payment is made.

With the submittal of the Project Record Documents the Contractor shall submit a list of each document submitted and a certification that each document as submitted is complete and accurate.

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SECTION 01730

GUARANTEES AND WARRANTIES

PART 1 GENERAL

1.1 GENERAL WARRANTY

A. The Contractor shall warrant all equipment, materials, products, and workmanship provided by the Contractor under these Contract Documents for a period of 12 months after the date of final acceptance of the Work by the Owner.

B. If, during the warranty period

1. any equipment, materials, or products furnished and/or installed by the Contractor are found to be defective in service by reason of the Contractor's faulty process, structural and/or mechanical design or specifications, or
2. any equipment, materials, or products furnished and/or installed by the Contractor are found to be defective by reason of defects in material or workmanship, the Contractor shall, as soon as possible, after receipt of written notice from the Owner, repair or cause to be repaired such defective equipment, materials or products, or replace such defective equipment, materials or products.

C. In the event of multiple equipment failures of major consequence prior to the expiration of the one-year warranty described above, the affected equipment shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components that may have been damaged or rendered non-serviceable as a consequence of the equipment failure shall be replaced. A new 12-month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item of equipment is reassembled and placed back into operation. As used herein, multiple equipment failures shall be interpreted to mean two or more successive failures of the same kind in the same item of equipment or failures of the same kind in two or more items of equipment. Major equipment failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts or structural members, broken or chipped gear teeth, overheating, premature bearing failure, excessive wear, or excessive leakage around seals. Equipment failures which are directly and clearly traceable to operator abuse, such as operating the equipment in conflict with published operating procedures, or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over- or under-lubrication, and the use of maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the 1-year warranty. Should multiple equipment failures occur in a given item or type of equipment, all equipment of the same size and type shall be disassembled, inspected, modified or replaced, as necessary, and rewarranted for 1 year.

D. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability with the law of the place of construction.

1.2 START-UP OF OPERABLE COMPONENTS

A. Because of the need to maintain operation during construction, it will be necessary to accept and start-up operable components of the project at various times prior to the completion and final acceptance of the entire project.

B. A component of the project, as used herein, shall mean a complete process subsystem and shall include all associated structures, equipment, piping, and controls, etc.

C. When a component of the project has been completed, checked out, field- tested, and made ready for operation, the Contractor shall notify the Engineer in writing that the component is substantially complete and request an inspection for substantial completion. The Engineer will schedule the inspection within 10 days of the Contractor's request. If the Engineer concurs in the Contractor's statement, the Engineer will notify the Contractor in writing that the component is accepted as substantially complete. At the same time, the Engineer will submit to the Contractor a list of items that must be completed or corrected before final acceptance can be given.

D. If a component of the project is needed in order to maintain operation during construction and if it has been accepted as substantially complete, the Contractor shall start up the component when directed by the Engineer. Once the component has achieved stable and satisfactory operation (minimum 95 percent availability over a 7-day period), the Contractor shall request beneficial occupancy by the Owner. The Owner, if he concurs in the Contractor's statement, that stable and satisfactory operation has been achieved, will notify the Contractor in writing within 10 days that he is assuming beneficial occupancy of the component.

E. On the date that the Owner assumes beneficial occupancy, the following shall occur:
   1. The one-year warranties for the component specified in Part 1.01 of this section will begin; and
   2. The Owner will assume responsibility for operating and maintaining the component.

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SECTION 01740

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 DESCRIPTION

The Contractor shall provide six copies of a complete and comprehensive reference manual containing operation and maintenance data to enable operators and plant engineers correctly operate, service, and maintain all equipment and accessories covered by the detailed equipment specifications. The data contained in the manual shall explain and illustrate clearly and simply all principles and theory of operation, operating instructions, maintenance procedures, calibration procedures, and safety precautions and procedures for the equipment involved. Safety precautions and procedures shall be stressed.

1.2 SUBMITTAL

A. The Contractor shall submit to the Engineer for approval two preliminary copies of the data reference manual with all specified material before the work covered by these Contract Documents is 50 percent complete. No payment for greater than 50 percent of the Contract Price will be made until all the preliminary copies of the manual are submitted and the submittal is satisfactory to the Engineer. Before the work is 80 percent complete, the Contractor shall submit six copies of each manual complete in detail as specified below. No payment for more than 80 percent of the Contract Price will be made until all the final copies of the manuals are submitted and the submittal is satisfactory to the Engineer. The Engineer will notify Contractor in writing of any deficiencies in the manual and will return the manual for completion and/or correction. The Contractor shall submit six copies of any revised or additional data required to complete the manual or as required by the Engineer.

B. At the time of the inspection for substantial completion, the Engineer will notify the Contractor of any revisions, corrections or incomplete data required for the satisfactory completion of the Operation and Maintenance Data Reference Manual. The Engineer will not recommend final acceptance of the work until the Operation and Maintenance Data Reference Manual is complete and satisfactory to him.

1.3 CONTENTS OF OPERATION AND MAINTENANCE DATA REFERENCE MANUAL

A. The Operation and Maintenance Data Reference Manual shall contain, but is not limited to, the following information on all equipment and accessories furnished and installed under these Specifications:
   1. Equipment function, normal operating characteristics, and limiting conditions for all equipment furnished.
   2. Detailed assembly, installation, alignment, adjustment, and checking instructions for all equipment furnished.
   3. Detailed operating instructions for start-up, calibration, routine and normal operation, regulation and control, shutdown and emergency conditions for all equipment furnished.

4. Detailed lubrication instructions and schedules for all equipment furnished including identification of lubricant (description, specification, and trade name of at least two manufacturers), diagrams illustrating lubrication points.
5. Detailed guide to "troubleshooting" for all equipment furnished.
6. Detailed parts lists identified by generic title, materials of construction and part number (actual manufacturer's number, not Supplier's) list of recommended spare parts identified as specified above, predicted life of parts subject to wear, and an exploded view of each equipment assembly for all equipment furnished.
7. Detailed disassembly, overhaul, and reassembly instructions for all equipment furnished.
8. Electrical and instrumentation schematics for all equipment furnished, including motor control centers, control panels, instrument panels, and analyzer panels.
9. List of all special tools required and description of their use for all equipment furnished. Special tools include any tool not normally available in an industrial hardware or mill supply house.
10. Detailed preventative maintenance procedures and schedules for all equipment furnished.
11. Detailed list of settings for relays, pressure switches, temperature switches, level switches, thermostats, alarms, relief valves, and rupture discs, etc.
12. One copy of all record shop drawings and engineering data for all equipment furnished.
13. Performance and characteristic operating curves for all equipment furnished.
14. List of names and addresses of nearest service centers for parts, overhaul, and service.
15. One copy of any instructions and parts lists attached to equipment when delivered.
16. Procedures for storing, handling, and disposing of any chemicals or products used with the equipment or system.

1.4 ASSEMBLY OF OPERATION AND MAINTENANCE DATA REFERENCE MANUAL

A. Each copy of the data reference manual shall be assembled in one or more loose leaf binders, each with title page, typed table of contents, typed list of tables, typed list of figures, and heavy section dividers with copper reinforced holes and numbered plastic index tabs. Binders shall be three-ring, hardback type, black in color, with transparent vinyl front cover and zipper suitable for inserting identifying cover and with a transparent vinyl pocket on the spine for label. All data shall be punched for binding; and composition and printing shall be arranged so that punching does not obliterate any data. The cover and binding edge of each manual shall have the project number and title, specification division number and title, and manual title printed thereon, all as approved by the Engineer.

B. All copies of shop drawings, figures, and diagrams shall be reduced to either $8^1/_2$ by 11 inches or to 11 inches in the vertical dimension and as near as practicable to 17 inches in the horizontal dimensions. Such sheets shall be folded to $8^1/_2$ by 11 inches. The manual and other data shall be printed on first quality paper, $8^1/_2$ by 11-inch size with standard three-hole punching. Drawings and diagrams shall be reduced to $8^1/_2$ by 11 inches or 11 by 17 inches. Binders shall be labeled Vol. 1, Vol. 2, etc., where more than one is required. The table of contents for the entire set, identified by volume number, shall appear in each binder. Text, figures, and drawings shall be clearly legible and suitable for dry process reproductions.

C. No separate payment will be made for the Operation and Maintenance Data Reference Manual and the cost of said manual shall be included in the Contract Price.

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DIVISION 2: SITE WORK

SECTION 02100

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 DESCRIPTION

A. Clearing and grubbing includes, but is not limited to removal from the project lands of trees, stumps, roots, brush, structures, abandoned utilities, trash, debris, and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures to prevent damage to existing features to remain is part of the work.

B. Existing structures left on the job site are to be removed by Contractor from the project lands upon the direction of the owner. Structures may be demolished and properly disposed of or moved.

1.2 QUALITY ASSURANCE

A. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state or federal authorities having jurisdiction over the project. All required permits shall be obtained for construction operations by the Contractor.

B. Open burning will have to be permitted with the city/county air pollution bureau and/or the local fire department. The Contractor is hereby made responsible for said permit and for any fees to be paid in obtaining said permit.

1.3 JOB CONDITIONS

A. Prior to bidding the work, the Contractor shall examine and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site; including, without limitation, the character of surface or sub-surface conditions and obstacles to be encountered on and around the construction site; and shall make such investigation as he may deem necessary for the planning and proper execution of the work.

B. The area to be cleared and grubbed is shown schematically on the drawings. It includes all areas designated for construction.

C. Disposal of unburnable debris shall be made off-site, or as directed by the Engineer. Burying of vegetative debris on site will not be permitted.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. The Contractor shall furnish equipment with operators of the type normally used in clearing and grubbing operations including, but not limited to tractors, trucks, loaders, root rakes, and burning equipment.

B. The Contractor shall furnish discing equipment capable of plowing the soil to a depth of 6 inches twice in a single pass.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

A. Materials to be cleared, grubbed and removed from the construction area and lands of the Owner include, but are not limited to the following: all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, houses, debris and abandoned utilities.

B. Surface rocks and boulders shall be grubbed from the soil, stockpiled, and/or placed in embankments in accordance with the Specifications.

C. The entire construction area shall be grubbed by heavy tractors with root rakes. Raking shall generally proceed along the contour rather than up and down slopes so as to inhibit soil erosion.

D. Grubbing shall consist of completely removing roots, stumps, trash, and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.

E. Burying of residual materials will not be allowed.

F. Stumps and roots shall be grubbed and removed to a depth not less than 2 feet below grade. All holes or cavities which extend below the subgrade elevation of the proposed work shall be filled with crushed rock or other suitable material, compacted to the same density as the surrounding material.

G. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage his operations have inflicted on such property.

3.2 DISCING

A. After grubbing is complete, discing of the entire area is required. Discing shall be done in two directions at approximate right angles. The second discing shall generally be done along the contour.
B. The construction area is to be left free-draining with a finished agricultural appearance.

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SECTION 02115

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and General Provisions of the Contract, including General and Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes all Contractor provided labor, systems, materials, etc. to provide complete site erosion control in conformance with these specifications as well as all applicable local, State and Federal regulations in sufficient detail to control the spread of wind and water borne materials that would be detrimental to adjoining public or private property, the site, and improvements on the project. These measures shall include the Contractor's construction and maintenance of temporary erosion control features as shown in the plans or as may be directed by the Owner's Representative.

B. The "Operator" as referred to herein or in any regulatory documents or permits shall mean the Contractor.

1.3 REFERENCE STANDARDS

A. Section 104 of the FDOT Standard Specifications, most recent edition.

B. Rule 62-621.300 (4), F.A.C. and the "Generic Permit for Stormwater Discharge from Large and Small Construction Activities", FDEP Document 62-621.300(4) (a).

1.4 SUBMITTALS

A. Prior to the pre-construction meeting, the Contractor shall obtain, prepare and submit the FDEP Form 62-621.300 (4) (b), "Notice of Intent (NOI) to use a Generic Permit for Stormwater Discharge from Large and Small Construction Activities". The type of project or activity that qualifies for use of the Generic Permit, the conditions of the permit, and additional requirements to request coverage are specified in the Generic Permit document (FDEP Documents 62-621.300 (4) (a). The appropriate Generic Permit fee, as specified in Rule 62-4.050 (4) (d), F.A.C., shall be submitted with the NOI in order to obtain permit coverage. Submit a copy of the NOI and confirmation of receipt of the NOI and fee from the NPDES Stormwater Notices Center prior to the pre-construction meeting.

B. The Contractor shall submit to the Engineer a detailed "Erosion and Sediment Control Plan" and "Stormwater Pollution Prevention Plan" (SWPPP) for review. Included shall be plan (s) of the site locating all siltation skirts, hay bales, turbidity curtains, and other features required to control erosion, sediment, water and air pollution, on and off the site. The plan shall be sequenced to show changes during the life of the project; shall be coordinated with on-site

stockpiling of fill and top soil; and shall be directly coordinated with the construction sequence for stormwater improvements. The Contractor shall not start any earthwork or site clearing until the plant is “Owner’s” Representative.

C. The plan shall include catalog cuts of all materials provided in support of the plan. The “Erosion and Sediment Control Plan” and SWPPP shall be submitted at or before the preconstruction conferences.

D. At the conclusion of construction and prior to final acceptance by the Engineer, the Contractor shall complete and submit the FDEP Form 62-621.300(6), “Notice of Termination (NOT) of Generic Permit Coverage” in accordance with the instructions contained therein. Submit a copy of the NOT and confirmation of receipt of the NOT from the NPDES Stormwater Notices Center prior to final acceptance by the Engineer.

1.5 PERMANENT EROSION CONTROL

This section is not intended to address the permanent Contractor installed erosion control features such as groundcover, pea gravel, grading, and the installation of drainage structures. It applies only to the temporary efforts required of the Contractor during the full construction process. The Contractor shall incorporate the permanent erosion control features into the project as soon as possible.

PART 2 PRODUCTS

2.1 SILTATION FENCES

The siltation fences shall be geotechnical woven or non-woven fabric conforming to the applicable application requirements of Section 985 of the Florida Department of Transportation “Standard Specifications for Road and Bridge Construction”. The type and size of posts and wire mesh reinforcement will be at the option of the Contractor and applicable to the installation conditions.

2.2 EROSION CONTROL MATTING

Erosion control matting shall be woven, biodegradable geotechnical fabric. It shall be used to temporarily stabilize channels or steep slopes until vegetation is established. This type selected shall be comparable to the grass cover applied for the particular installation. The material shall be stapled in place at 18 inches on center with a minimum matting lap of 4 inches.

2.3 HAY OR STAW BALES

Hay and straw bales shall be individual bales each entrenched 4 inches into the soil. The bales shall be clean, fresh hay or straw. Bales shall be replaced when they become clogged with silt, deteriorate, or after a period or 3 weeks, whichever occurs first. The particular application may require that bales be staked into the ground with rebar.

2.4 TURBIDITY CURTAINS

Turbidity curtains shall be floating of sufficient depth to reach within 1.0 feet of the bottom of the receiving water. They shall be similar to the types manufactured by the American Boom and Barrier Corp. They shall yellow or international orange in color. The material shall be 45 mils thick (18 to 22 oz/sq. yd) and fully sewn or vulcanized seamed to provide flexible and buoyant units. The top floatation shall maintain a 3-inch freeboard above the water surface.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall install and maintain all necessary temporary erosion control features for the full period of construction. These features shall be coordinated with all applicable construction features to assure the continuous and effective control of erosion and degradation of surface water quality on and adjoining the site. In the event of unforeseen conditions, the Owner may require the use of control features utilizing methods other than those indicated or proposed by the Contractor.

B. The Contractor shall perform all clearing and grubbing operations such that the area of unprotected erodible earth exposed at any one time is not larger than the minimum area necessary for efficient construction operations, and the duration of exposed, uncompleted construction shall be kept as short as practicable.

3.2 EARTHWORK PROCESS

A. The Owner may limit the area of unprotected erodible earth exposed by clearing, grubbing, excavation, backfilling, or stockpiling operations and may direct the Contractor to provide immediate temporary erosion or pollution control measures to prevent erosion, degradation or receiving water, or windblown transfer of materials. As a result, the Contractor's efforts shall be in keeping with his capability to grade, gravel, and install the permanent erosion control measures.

B. If unforeseen erosion problems arise as a result of the design, weather conditions, or the Contractor's operations, the Contractor shall be required to implement acceptable temporary erosion control features during construction when the Owner so directs.

3.3 TEMPORARY EROSION CONTROL

A. A. General: Temporary erosion and water pollution control features shall consist of, but not be limited to, temporary groundcover, temporary gravel, temporary mulching, sandbagging, slope drains, sediment basins, sediment checks, berms, baled hay or straw, floating turbidity curtain, and silt staked fence. The Contractor may find design details for some of these items in the Water Quality Section of the applicable edition of the Florida Department of Transportation "Department's Roadway and Traffic Design Standards." The Owner's Representative may direct use of temporary erosion control features or methods other than those indicated herein. Any such advice given to the Contractor by the Owner shall not relieve the Contractor from fully preventing erosion.

B. Temporary Groundcover or Gravel: The Contractor may provide temporary gravel or groundcover with mulching to provide temporary erosion control in areas where applicable or where site conditions warrant. The Contractor shall obtain the approval of the Owner for the use of all forms of temporary groundcover. Where temporary groundcover is provided, the final condition of the plant material may warrant its removal and replanting at no additional cost the Owner.
C. Temporary Mulch: This work shall consist of furnishing and applying a 2-inch to 4-inch thick blanket of straw of hay mulch into the top 2 inches of the soil in order to temporarily control erosion. Only undecayed straw or hay, which can readily be cut into the soil, shall be used. Other measures for temporary erosion control such as hydro mulching, chemical adhesive soil stabilizers, etc. may be substituted for mulching with straw of hay if approved by the Owner's Representative. When permanent grassing operations begin, temporary mulch materials shall be plowed under in conjunction with preparation of the ground.
D. Sandbagging: This work shall consist of furnishing and placing sandbags in configurations so as to control erosion and siltation.
E. Slope Drains: This work shall consist of constructing slope drains, utilizing pipe, fiber mats, rubble, cement concrete, asphaltic concrete plastic sheeting, or other acceptable materials, or as may be approved as suitable to adequately perform the intended function.
F. Temporary Sediment Basins: Temporary sediment basins, if necessary, shall be constructed to adequately perform the intended function. Sediment basins shall be cleaned out as necessary to maintain flow function or as directed.

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SECTION 02200

EARTHWORK

PART 1 GENERAL

1.1 DESCRIPTION

A. Earthwork includes, but is not limited to excavating, filling, compacting, and grading to obtain the required finished ground surface properly prepared to receive pavements, buildings, and drainage structures.

B. The work includes ditching in ground areas of high water table to allow the soil to drain prior to making excavations.

C. The work includes adjustment of moisture content of soils placed in fills if soil tests show it necessary to allow compaction requirements to be met.

D. The work includes the reduction of all ripable rock materials encountered in the course of the work to the sizes and gradations suitable for placement in rockfills and riprap. Included are all surface boulders as well as ripable rock materials encountered in excavations.

E. The work includes the removal of surface soils into stockpiles and placement of same into designated locations including roadway embankments, drainage areas, curb and island backfills, and roadway shoulders.

F. The work includes construction staking to control earthwork construction.

G. The work includes undercutting unsuitable soil materials and replacing with compacted, approved on-site soils.

1.2 QUALITY ASSURANCE

A. Soil testing will be done on a continuous basis while grading operations are underway.

B. The Contractor shall be solely responsible for all lines, levels and measurements for this work. He shall provide his own instruments and survey crew to maintain this control throughout the duration of his work.

C. Testing and inspecting services will be the responsibility of the Contractor by an independent testing company provided approved by the Owner. When scheduling testing, the Owner requires a minimum of 24 hours' notice with a preferred 48-hour notice prior to testing. Copies of all test reports shall be submitted to the Engineer. The testing company will have an authorized representative on the site to check compaction and determine suitability of fill materials during the grading operations.

1.3 JOB CONDITIONS

A. Erosion control measures shall take place prior to the start of any grading work.

B. Prior to bidding the work, the Contractor shall examine and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site; including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such investigation as he may deem necessary for the planning and proper execution of the work.

C. The Engineer shall be immediately notified if suspected unsuitable foundation or subgrade material is encountered during Contractor's grading activities.

D. A soil report and boring logs have been prepared for this site. This information was gathered solely for the use of the Designers and is not to be used as a basis for calculations in preparing a bid. The use and interpretation of the geotechnical information for any purpose will be entirely the responsibility of the using party. Neither the Owner nor the Engineer gives any guarantee, either expressed or implied; that the borings or geotechnical report represent a true cross section of all the material to be encountered in performing the excavation and earthwork on this project.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Fill materials for embankments shall be clear soil containing no rocks larger than 6 inches and rockfill, if rock is produced by excavating on site.

B. The top 4 inches of all permanently vegetated areas shall be soil material of good quality.

C. Backfill material for structures and retaining walls shall be material obtained off site. Backfill material is subject to approval by the Engineer.

D. Special backfill, where specified, shall be crushed stone or natural or manufactured sand subject to approval of the Engineer.

E. Drainage fill shall be Size #57 crushed stone meeting ASTM C33.

PART 3 EXECUTION

3.1 GRADING

A. Stripping

1. Cut areas and embankment areas shall have all organic topsoil, brush, and other deleterious materials and obvious loose surface materials removed. Undercutting of alluvial soils which exist in drainage features is required.

B. General Grading Requirements

1. For general grading, the finished contours and spot elevations shown on the drawings indicate the finished surface to be obtained by construction. Grades not otherwise shown shall be straight lines between points where elevations are shown. Provide rounding at the top and bottom of slopes and at intersections of planes. Where profiles and typical sections are provided, the profiles and typical sections shall have precedence over the grading plans.
2. Where pavement or building construction is indicated, Contractor shall make due allowance for the thickness of pavement or building structures. Contractor shall note that areas to receive topsoil or riprap are to be left at such grades and elevations that when topsoil or riprap are placed, the finished surface will conform to that shown on Drawing.
3. Grading operations shall be so conducted that materials shall not be removed or loosened beyond the required limits.

C. The finished surfaces shall be left in smooth and uniform planes such as are normally obtainable from the use of hand tools. If the Contractor is able to obtain the required degree by evenness by means of mechanical equipment, he will not be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished to slopes shown on the Plans unless otherwise approved by the Engineer in writing.

1. Mass Graded Areas: Finish areas within not more than 0.50 foot above or below the required subgrade elevation provided drainage patterns remain unchanged.
2. Pavements, Buildings, and Drainage Features: Shape surface of areas to line, grade, and cross-section with finished surface not more than 0.10 foot above or below the required subgrade elevation.

3.2 PROOFROLLING

All areas that will support fill, pavement, foundations, or slabs shall be proofrolled with a fully loaded tandem dump truck (or equivalent) to detect soft areas. Proofrolling shall be observed by an experienced Geotechnical Engineer from the testing laboratory hired by the Owner. Proofrolling shall be accomplished by making two complete passes in each of two perpendicular directions. Any areas which exhibit "pumping" (indicating soft spots) shall be undercut to a level specified by the Geotechnical Engineer and replaced with approved fill material compacted in accordance with requirements for fill as specified herein.

3.3 EXCAVATION

A. Excavation consists of removing all materials encountered in establishing required grade elevations, utility installations, and other job requirements. Excavation includes transporting and placing material in embankments, backfills, or temporary stockpiles as required to meet the requirements of the Plans and Specifications.

B. No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in the performance of contract work, regardless of type, character, composition, or condition thereof.

C. General Excavation Requirements
   1. Excavation operations shall be managed to ensure proper placement of soil materials not suitable for placement near the surface of embankments. If necessary, the Contractor shall temporarily stockpile excavated earth so that it will be available to top off embankments.
   2. Stability of Excavation: Slope sides of excavations to comply with local codes and ordinances having jurisdiction and with good construction engineering practice. Shore and brace where sloping is not possible either because of space restrictions or stability of material encountered. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
   3. Dewatering Excavations: Prevent surface water and subsurface or groundwater from flowing into structure excavations.
      a. Do not allow water to accumulate in structure excavations. Remove water to prevent softening of foundations. Provide and maintain sumps, pumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
      b. Convey water removed from excavations to storm drain system or outfall ditches. Provide and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
   4. Material Storage: Stockpile as directed by Engineer satisfactory excavated materials until required for backfill or fill. Place, grade and shape stockpiles for proper drainage and protect from erosion. Locate and retain soil materials away from edge of excavations.
   5. Excavation for Structures: Conform to the elevations and dimensions shown within a tolerance of plus or minus 0.10 foot and extending a sufficient distance from footings and foundations to permit placement and removal of concrete formwork, installation of services, and other construction required, and for inspection.
   6. Areas of excavation as indicated on the Plans shall be excavated to the limits shown with no classification of excavated material. Excavated rippable rock shall be incorporated in construction of the fills with the method of construction subject to the Engineer's approval. Broken rock resulting from drilling, blasting or other methods may also be utilized in fill construction, subject to Engineer's approval of maximum size of rock, method of construction and areas of placement.

D. Limits of Rock Excavation: Limits are minimum dimensions to which any part of the rock encountered will be allowed to remain.
   1. Beneath pavements, excavate to 6 inches beneath base course.
   2. Beneath structures, excavate 12 inches beneath bottom of structure.
   3. Beneath pipe in trenches, excavated 8 inches beneath the bottom of pipe.

E. Unauthorized Excavation
   1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer.
   2. Unauthorized excavation shall be backfilled and compacted with fill material or special backfill as directed by the Engineer.

F. If the Contractor encounters unsuitable material below subgrade elevation while accomplishing excavation, it shall be removed and replaced as directed by the Engineer. In no case shall objectionable material be allowed in or under the subgrade. Final determination of the classification of any material as unsuitable shall be made by the Geotechnical Engineer and such decision shall be final.

3.4 EMBANKMENT AND BACKFILL CONSTRUCTION

A. Place acceptable and appropriate material in compacted layers to the required subgrade elevations for each area classification to be filled. All materials entering the fill shall be free of organic material, such as leaves, grass, roots and other objectionable material.

B. Embankments
   1. Prior to commencement of grading operations, the Contractor shall proofroll all areas that will receive fill with a fully loaded tandem dump truck. Where quicksand, soft clay, swampy or other material unsuitable for subgrade or foundation purposes is encountered, it shall be removed and disposed of to the level of suitable material. Areas so excavated shall be backfilled with approved material compacted by tamping to the density of the surrounding suitable material and to the lines and grades shown on the Drawings. Unsuitable material will be disposed of within the spoil areas, as designated by the Engineer. Final determination of the classification of any material as unsuitable shall be made by the Geotechnical Engineer and such decision shall be final. In areas that will receive deep fills, the material may remain and be bridged as directed by the Engineer. No additional payment will be made for bridging by using track vehicles only prior to placement and compaction of fill with pans and sheepsfoot rollers.
   2. Rockfill and soils classified other than common excavation may be used only in embankment areas and then in thin layers at the very bottom of fill and more than 8 feet below finished grade and more than 6 feet beneath paving subbase course.
   3. Fills shall be formed of satisfactory materials placed in successive horizontal layers of not more than 6 inches in loose depth for the full width of each strip. A strip shall be defined as being no less than 8 feet wide. Rockfill may be placed in layers up to 12 inches thick in the lower portion of fills unless otherwise approved by the Engineer.

C. Structure and pipe backfill shall be placed in thin layers and compacted to the required minimum densities for fills. Backfill placement shall be balanced to prevent wedging action on structures and pipes.

D. Backfill in storm sewer, sanitary sewer, water line, or any other trenches which lie *under pavement* shall be #57 crushed stone compacted to the required minimum densities for fills and installed according to District specifications.

E. Rockfill shall be placed in embankments from the bottom upward. In no case shall earthfill material be buried underneath rockfill or soils classified other than common excavation. Earthfill material shall be stockpiled as required to allow the total quantity of rockfill to be placed in permissible locations as defined above.

F. In areas where rock or unsuitable soils are excavated to allow construction of pavements, structural fill shall be placed and compacted as shown below.

G. Compaction
   1. General: Control soil compaction during construction providing densities as specified when tested by ASTM 698.
   2. Standard proctor tests (ASTM 698) shall be done in accordance with generally accepted practice by the testing laboratory hired by the Owner for the purpose of comparing field densities to standard proctor test maximum densities unless noted otherwise or instructed otherwise by the Engineer, field density testing. Field density testing should be performed on each lift prior to placement of additional lifts. Test locations should be evenly distributed throughout the fill area and should be performed at the frequencies shown on the following table:

Area	Method of Placement / Completion	Initial Test Frequency	Retest Frequency
General Site	Large self-propelled equipment	1 test per lift per 5,000 square feet	1 test per failed test
Isolated Areas	Hand-guided equipment	1 test per lift	1 test per failed test
Trench backfill and behind retaining walls	Hand-guided equipment	1 test per 50 linear feet per 6 inches of fill	1 test per failed test

   Test frequencies may be increased during the early stages of earthwork construction. Compaction requirements apply to all excavation/backfill operations conducted on site.
   3. Soils shall be placed at a moisture content which is within minus 1 or plus 3 percentage points of the optimum moisture content and to the following percentages of the maximum dry density as determined by ASTM 698:
      a. All Embankments and Backfills: Compact to 95 percent except as hereinafter specified.
      b. Top 12 Inches of Subgrade Under Pavements: Compact to 100 percent.
      c. Top 12 Inches of Subgrade Under Slabs: Compact to 100 percent.
      d. Rockfill shall be compacted by passes of heavy equipment or by drum type vibrating compactors as required to achieve a relative density of 75 percent or as directed by the Engineer.

H. Curbed shoulders and islands shall be backfilled with stockpiled surface soils if available after other uses are completed. Contractor shall place surface soils from stockpiles in a 4-inch minimum thickness layer on all areas designated for planting, grassing, etc.

I. Any areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers. The equipment shall be operated in such a manner that weathered rock, cemented

gravel, clay or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

J. In the construction of filled areas, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, additional layers shall be constructed in horizontal planes. Unless otherwise directed by the Engineer, original slope shall be continuously vertically benched to provide horizontal fill planes. The size of the benches shall be formed so that the base of the bench is horizontal, and the back of the bench is vertical.

K. As many benches as are necessary to bring the site to final grade shall be constructed. Filling operations shall begin on the lowest bench, with the fill being placed in horizontal 6 inch loose lifts unless otherwise authorized by the Engineer. The filling shall progress in this manner until the entire first bench has been filled, before any fill is placed on the succeeding benches. Proper drainage shall be maintained at all times during benching and filling of the benches, to ensure that all water is drained away from the fill area.

L. The Contractor shall be responsible for the stability of all fills made under the contract, and shall replace any portion which, in the opinion of the Engineer or his designated representative, has become displaced due to carelessness or negligence on the part of the Contractor. Fill damage by inclement weather shall be repaired at the Contractor's expense.

3.5 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion and keep free of trash or debris. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, remove to sound material, reshape, and compact the required density prior to any further construction.

3.6 EROSION CONTROL

The Contractor shall utilize hay bales and other erosion control devices not only as detailed on the Drawings or required by the Specifications, but at such times and places are as necessary to satisfy local and governmental laws and regulations, to keep silt from washing onto existing paved surfaces, protect culverts or other drainage structures, or as directed by the Engineer.

END OF SECTION

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SECTION 02215

SUBGRADE CONSTRUCTION AND PREPARATION

PART 1 GENERAL

1.1 SCOPE

The work described in this section includes furnishing all labor and equipment necessary for the construction and preparation of part or all of the roadbed to receive the immediate construction of a base or pavement thereon.

PART 2 EXECUTION

2.1 EQUIPMENT

All equipment necessary and required for the construction of the subgrade must be on the project, proven to be in first-class working order, and approved by the Engineer before construction will be permitted to begin. This shall consist of at least one motor grader with scarifier and one pneumatic tired roller meeting the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

2.2 SUBGRADE PREPARATION

A. Road and drainage excavation and embankment construction shall be performed in accordance with the provisions set out in Section 02200 "Earthwork" of these Specifications.

B. The subgrade shall be prepared to the lines and grades staked by the Engineer and to correspond to the cross section of the bottom of the pavement as indicated on the Drawings or as directed.

C. Where excavation is necessary to prepare the subgrade, the material removed shall be carefully stored or placed for use in completing the roadbed. Unsuitable material shall be wasted as directed by the Engineer.

D. All rock shall be removed to a depth of not less than 6 inches below the surface of the subgrade and all holes or depressions, caused by the removal of rock, or otherwise, shall be backfilled with satisfactory material and thoroughly compacted.

E. Where the roadbed is below grade the Contractor shall prepare the subgrade by hauling and spreading satisfactory material excavated in channeling, or otherwise. The material shall be spread in layers not to exceed 6 inches in thickness and thoroughly compacted by rolling, and using water if directed. Each layer shall have been completed before the succeeding layer is started.

F. Where it is intended or required to use steel forms in the construction of the base of pavement, the subgrade shall be constructed at least 12 inches wider, on each side, than the neat width of

the base of pavement. For bases or pavements using wooden forms, the subgrade shall be constructed at least 6 inches wider, on each side, than the width of the base or pavement, as indicated on the Drawings or as directed.

G. Where sub-bases are to be constructed on the subgrade, the limits of the subgrade preparation shall extend across the entire section upon which any subbase course is to be applied, including the shoulders.

H. When the subgrade is being prepared for the construction of a Portland cement concrete base or Portland cement concrete pavement it shall be formed to the approximate grade and cross section. The preparation of the subgrade shall be performed in conformity with the requirements set out in the section covering the particular type of construction.

2.3 SUBGRADE COMPACTION

A. After the subgrade has been approximately prepared and shaped, it shall be loosened in its entirety by discing, harrowing or other approved methods to a depth of not less than 6 inches prior to its being compacted to the approved density. The subgrade shall then be thoroughly compacted with the approved 10-ton roller or pneumatic tired roller. The density shall be 100 percent of AASHTO density when tested by the Standard Specifications for Compaction and Density of Soils, AASHTO Serial Designation T 99 (latest revision). The limits of the subgrade compaction shall extend across the entire section upon which any base or subbase course is to be applied, including the shoulders. Prior to reworking and compacting the subgrade, all vegetation within the limits as set out above shall be removed and properly disposed of as directed by the Engineer.

B. All soft, yielding material, which will not compact readily under the roller, shall be removed as directed. All holes or depressions caused by the removal of material, as described above, shall be backfilled with satisfactory material and the entire surface thoroughly compacted with the roller where possible, or otherwise when directed by the Engineer.

C. The subgrade shall be checked after the rolling and adjusted so as to conform to the grade and cross section, as indicated or directed. It shall be rerolled if directed.

D. The final rolling of the subgrade, preparatory to the construction of the Portland cement concrete base or pavement thereon, shall be preformed between the forms after they are finally set to line and grade.

2.4 SCOPE OF SUBGRADE

The subgrade shall be true to lines, grades, and cross sections; must be free from dust or other loose material; must have a uniform bearing power; and shall be prepared and maintained at least 500 feet in advance of the placing of any materials thereon, except between November 1 and April 1, the distance may be reduced to 200 feet if permitted by Engineer.

2.5 DRAINAGE

A. Grading of the subgrade shall be performed in such a manner that berms of earth or other material which will interfere with the immediate drainage of water from the subgrade to the side ditches will not remain on the roadbed, at any time. All side ditches and drains shall be maintained to provide for proper drainage during the construction.

B. All ditches and drains shall be completed so as to drain the roadbed effectively before the placing of any construction materials will be permitted.

2.6 PROTECTION OF SUBGRADE

A. In handling materials, equipment, tools, etc., the Contractor shall take all precaution necessary to protect the subgrade from damage. Only hauling necessary for the purpose of construction will be permitted on the subgrade after it has been completed.

B. If ruts of 2 inches or more in depth are formed in the subgrade, all construction materials, whether stored or in place, within the range of such ruts, shall be removed and the subgrade shall be reshaped and rolled. All ruts or rough places developing in a completed subgrade shall be smoothed and the subgrade rerolled.

2.7 SUBGRADE CHECKING

A. The subgrade must conform to the lines, grades, and cross sections, indicated or directed, before it will be permitted to construct base or pavement thereon, and shall be subject to test just prior to construction.

B. The subgrade for base or pavement requiring steel side forms will be checked by a special tester, as provided in the section covering this type of construction.

C. All excess material shall be removed until the subgrade is at true elevation. Low subgrade shall be built up to the proper form and elevation when practical to roll, or if not practical to roll, it shall be filled as an integral part of the base or pavement at the Contractor's expense.

2.8 SITE CLEANING

The disposal of excess or unsuitable material shall be performed in accordance with the provisions set out in Section 01710 "Cleanup" of these Specifications and final cleanup shall be performed in accordance with the provisions set out in the Detailed Specifications of the Contract.

END OF SECTION

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SECTION 02575

PAVEMENT RESTORATION

Part I. GENERAL

1.1 Scope

A. The work included under this specification shall include the furnishing of all labor, material, and equipment necessary to satisfactorily restore road surfaces which have been damaged or destroyed during the performance of work under this Contract.

1.2 Referenced Specifications

NOT USED

1.3 Submittals

A. CONTRACTOR shall submit two (2) certified copies of all compaction tests specified below.

Part II. PRODUCTS

A. Pavement material shall be in accordance with the latest Florida Department of Transportation Specifications.

Part III. EXECUTION

3.1 General

A. The CONTRACTOR shall be responsible for temporary restoration of all roadway cuts and for maintaining all cuts in a drivable condition prior to final restoration. All settled areas shall be immediately refilled by the CONTRACTOR.

B. The CONTRACTOR shall be responsible for timely restoration, as determined by the ENGINEER. At no time shall more than 1,200 linear feet of ditch be open without permanent trench restoration.

C. The CONTRACTOR shall give a written notice to the ENGINEER at least 72 hours prior to commencement of resurfacing. If resurfacing will not be accomplished as a single operation, then individual notices shall be given for each section to be resurfaced.

D. The CONTRACTOR shall be responsible for the integrity of the Pavement Restoration for a minimum period of one year following the acceptance of the project.

E. At least every three months, the CONTRACTOR shall provide a complete overlay of all roads that have achieved final restoration.

3.2 County/CITY Secondary Road Crossings

A. Secondary road crossings which are open cut in areas where resurfacing is required shall be restored with a minimum of 12 inches of compacted limerock or shell base material or 8 inches of flowable fill.

B. Secondary road crossings made in unpaved and/or unsurfaced areas are to be restored in accordance with the details shown on the plans. Sufficient amount of approved material to be distributed on the roadway to provide a condition equal or greater than the condition of the road which existed prior to the commencement of construction.

3.3 Private Roadways

A. Private road crossings which are open cut in areas where the roadway is surfaced with bituminous material shall be restored in accordance with the details shown on the plans.

B. Private road crossings which are open cut in unpaved areas shall be restored in accordance with the details shown on the plans. Sufficient amounts of approved material shall be distributed on the roadway in such a manner as to leave the roadway in a condition substantially equal to that which existed prior to the commencement of construction.

3.4 Compaction and Testing

A. State, County and private road crossings which are open cut shall be compacted and tested as described herein.

B. Backfill below the road base material shall be compacted as shown on the plans for a Type "A" Trench.

C. Road base material shall be replaced and compacted in two or three layers, to attain a thickness of two (2) times the original base material thickness or a minimum of 12". Limerock, and Shell Bases shall be compacted to the density shown on the Plans.

D. The CONTRACTOR shall obtain a testing company to perform the required compaction density tests. The testing firm must have the approval of the ENGINEER prior to the commencement of construction. Each crossing must have two (2) tests performed on the compacted subgrade, and two (2) tests performed on the compacted base, at a minimum separation of 1/3 the traversed roadway distance. If any tested work fails to meet the specified compaction requirements, the testing company shall determine the extent of the faulty work, and all faulty work shall be re-excavated and replaced in accordance with this section, and the tests shall be repeated until specified requirements are met. Test data shall be submitted to the ENGINEER and approved by the ENGINEER prior to resurfacing of asphalt concrete roads.

3.5 Approvals

A. The work under this specification will not be considered complete nor satisfactory until approved by the ENGINEER as well as the applicable governmental agency.

END OF SECTION 02575

DIVISION 15: MECHANICAL

SECTION 15001

PIPE WORK GENERAL PROVISIONS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work under this Section includes all material certificates; Shop Drawings; disinfection of potable water mains; and field testing of all pipe, pipe fittings, piping specials, and valves in all sections necessary to complete and make serviceable all piping systems.

B. The requirements of this Section apply to the work in the following Sections:
   1. Section 15001, Pipe Work General Provisions
   2. Section 15064-A, PVC Pressure Pipe
   3. Section 15064-B, Polyvinyl Chloride Sewer and Service Pipe
   4. Section 15090, Pipe Couplings and Expansion Joints

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes and standards except as otherwise shown or specified.
   1. AWWA: All applicable standards.
   2. Florida Department of Environmental Protection: All rules and regulations.

1.3 SUBMITTALS

A. Material Certificates: Provide materials certificates signed by the material manufacturer and the Contractor for all pipe and pipe fittings. Certify that each material item complies with the specified requirements.

B. Shop Drawings: Submit Shop Drawings for all valves and special items, restrained joint systems for all systems, and laying schedules in accordance with Section 01340 of these Specifications.

PART 2 PRODUCTS

2.1 TEST RESULTS

The Contractor shall conduct all tests in the presence of the Engineer. Test results shall be certified to the Owner in writing.

2.2 TESTING OF PRESSURE PIPING SYSTEMS

A. Each section of piping shall be tested to a hydrostatic pressure of 150 psi (minimum) or 50 psi above the working pressure. The Contractor is required to furnish all pumps, gauges, instruments, test equipment, and personnel required for the tests, and make provisions for removal of test equipment and draining of pipes after tests have been made. All testing shall be made in the presence of the Engineer.

B. The pressure tests shall be sustained for not less than two hours and as long as the Engineer may require to assure that:
   1. No air pockets are in the line.
   2. No broken pipe or defective materials are in the line.
   3. No leaking joints have been made.

C. Before applying the specified test pressure, all air shall be expelled from the pipe. If outlets are not available at high places, the Contractor shall make the necessary taps at points of highest elevations before the test is made. After the test has been completed, corporation cocks shall be installed at these points and marked by the installation of a valve box.

D. Tests may be made of isolated portions of such piping as will facilitate general progress of the installation. Any revisions made in the piping systems will subsequently necessitate retesting of such affected portions of the piping systems.

E. Where city water service is available, reasonable amounts of water for flushing and testing will be furnished by the Owner at no cost to the Contractor subject to requirements which the Owner may impose.

F. Any defective material or defects in workmanship that become apparent during the tests shall be remedied and the subject piping shall be retested.

G. Prior to pressure testing of buried piping, backfill shall have been partially placed and tamped to provide adequate side support for all pipe and fittings. At joints, trenches shall be sufficiently open for joint inspection.

H. All piping systems shall be thoroughly flushed by providing a velocity of $2^{1}/_{2}$-feet per second in the line being flushed.

I. Do not test against closed valves at pressures higher than the allowable seating pressures for individual valves. Contractor may test open valves at pressures up to that specified for the valve bodies. In sections of the line where the test pressures are greater than the allowable seating pressures for the valves, the Contractor shall provide temporary plugs to test against.

J. The leaking tests which may be performed at the same time as the pressure tests shall be sustained for not less than 2 hours. The leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain the specified leakage test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

K. No pipe line installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{NDP^{0.5}}{7400}$$

L = allowable leakage in gallons per hour
N = number of joints in length of pipe line tested
D = nominal diameter of pipe in inches
P = average test pressure during leakage test in pounds per square inch

2.3 TESTING GRAVITY FLOW PIPING

A. General:

1. The following procedures apply only to the storm drainage systems. Tests for this piping may be waived at the Engineer's discretion.
2. Field testing of gravity flow pipes, including manholes, for joint integrity and water tightness shall be conducted by either an infiltration test or an exfiltration test. The Contractor shall furnish all plugs, pumps, piping, gauges, timers, instruments, required test apparatus, and all labor required for installing the testing equipment, conducting the test, and removing the testing apparatus after the tests have been completed. All testing shall be done in the presence of the Engineer.
3. The Engineer will determine the type of test required for each section after the ground water table has been measured by the Contractor. The following general criteria will govern the type of test to be conducted.
   a. Wherever the ground water table is measured to be not less than 1 foot above the top of the pipe throughout the full length in the section being tested, an infiltration test shall be used.
   b. Wherever the ground water table is measured to be less than 1 foot above the top of the pipe at the highest point in the section being tested, an exfiltration test shall be used.

B. Measuring Ground Water Table:

1. The Contractor shall provide facilities for measuring the ground water table at intervals equal to and not greater than the manhole spacing, etc., one probe per manhole.
2. Maximum allowable leakage permitted under this Specification is 25 gpd/inch of pipe diameter/mile for sanitary lines and 100 gpd/inch of pipe diameter/mile of pipe for storm water systems. The permissible leakage rate is established for either the infiltration or exfiltration test.
3. Testing, whether for infiltration or exfiltration, is to be performed by standard methods and are to be approved by the Engineer prior to conducting the tests.

C. Testing Gravity Flow Lines by Visual Inspection: All gravity flow sewers 18 inches diameter and smaller shall be subject to testing by visual inspection for alignment and grade. A section of pipe between two manholes will have passed the test when a light held in a manhole will show a full circle when viewed from an adjoining manhole through the carrier pipe. Visual inspection is in addition to I/E tests.

D. Failures: If, for any reason, a section of pipe fails either of the tests previously outlined or any substitute test procedure approved by the Engineer, the Contractor shall locate the defective

materials and/or installation and make any necessary repairs. After the corrective actions have been taken, the section of pipe shall be retested subject to the same provisions or requirements outlined above.

2.4 RELATIONSHIP OF SEWERS TO WATER MAINS

A. Sewer Parallel to Water Main: Sewers shall be located, during design, at least 10 feet horizontally from any existing or proposed water main. If, for absolutely essential reasons, it is not possible to achieve such separation, the sewer may be located not less than 3 feet from a water main - horizontally, provided there is at least 18 inches vertical separation between the bottom of the water main and the top of the sewer, with the sewer below the water main.

B. Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with slip-on or mechanical-joint ferrous pipe for a distance of 10 feet on each side of the sewer. One full length of water main pipe should be centered over the sewer so that both joints will be as far from the sewer as possible.

C. Special Conditions: When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the water main should be constructed of slip-on or mechanical-joint ferrous pipe and the sewer constructed of mechanical-joint ferrous pipe and both services should be pressure tested to assure watertightness.

D. Must meet all applicable Florida Department of Environmental Protection and local codes and regulations.

END OF SECTION

SECTION 15064-A

PVC PRESSURE PIPE

PART 1 GENERAL

1.1 SCOPE

A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test polyvinyl chloride (PVC) pressure pipe, including valves, unions, fittings, couplings, adaptors, and accessories, as shown on the Drawings and/or specified herein.

B. The Contractor's attention is called to the fact that all PVC piping and accessories are not necessarily shown completely on the Drawings which are more or less schematic. However, the Contractor shall furnish and install all piping indicated or required for proper operation of the equipment or services requiring such piping.

1.2 QUALITY ASSURANCE

A. The Contractor, at the Engineer's request, shall furnish a certificate from the manufacturer of the pipe and fittings that the manufacturer is fully competent and capable of manufacturing PVC pipe and fittings of uniform texture and strength that will fully comply with these specifications and have so manufactured this class of pipe in sufficient quantities to be certain that it will meet all normal field conditions of usage. The manufacturer must have adequate equipment and quality control facilities to be sure that each extrusion of pipe is uniform in texture, dimensions, and strength.

B. All pipe shall be tested and inspected at the place of manufacture for all requirements of the latest ASTM and commercial standard tests and certified copies of the test reports covering each shipment shall be submitted to the Engineer prior to laying.

C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:
   1. Nominal size
   2. Type and grade of material and ASTM standard
   3. SDR, class, or schedule rating
   4. Manufacturer
   5. National Sanitation Foundation's seal of approval

1.3 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Submittals" of these Specifications.

1.4 STORAGE AND PROTECTION

A. PVC piping and accessories shall be stored and protected in accordance with the requirements of these Specifications.

B. PVC pipe and fittings shall be stored under cover.

C. All pipe and accessories shall be stored aboveground and fully supported so as not to bend or deflect excessively under its own weight. Height of stacked pipe shall not exceed 4 feet. Bundled pipe shall not be stacked more than two bundles high.

D. Kinked, flattened, buckled, broken, or otherwise defective pipe and fittings shall not be used and shall be removed from the site.

E. Pipe shall be handled using nylon slings. Wire rope slings or chains shall not be

used. 1.5 GUARANTEE

Provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

PART 2 PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

B. The manufacturer shall provide waterstops, acceptable to the Engineer, which shall be applied to the outside of plastic pipe when the pipe is to be enclosed in any structure where concrete or mortar is used which will prevent leakage along the outer wall of the barrel of the pipe.

C. No single piece of pipe shall be laid on any project covered by this specification unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed 1/16-inch per foot of length. If the deviation from straightness exceeds this requirement, then the particular piece of pipe shall be rejected for use until it can comply with this provision.

D. Wyes, tees, bends, and adapters and any other fittings required or directed by the Engineer shall be constructed of ductile iron. Engineering data for such fittings showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. The materials used in the manufacture of fittings shall conform with the requirements for the pipe with which they shall be used and any variation of such requirements shall be subject to the approval of the Engineer. Fittings shall have wall thicknesses equal to or greater than that of the pipe to which they are joined.

2.2 PIPE

A. PVC pipe shown on the Drawings to be installed outside of structures or buried underground and used to convey water or wastewater shall have push-on joints unless otherwise noted on the Drawings. All pipe material shall be Grade 1, Type I, polyvinyl chloride (PVC) in accordance with ASTM D 1784, Class 12454-B. All pipe material shall be National Sanitation Foundation approved for use with potable water. Pipe in sizes $1^{1}/_{2}$-inches through 3 inches (1/2 inches through 12 inches for corrosive fluids) shall be SDR 21 with 200 psi pressure rating in accordance with ASTM D 2241. Pipe in sizes 4 inches through 12 inches shall be either SDR 21 with 200 psi pressure rating in accordance with ASTM D 2241 or Class 200 in accordance with AWWA C 900, depending on which is called for on the Drawings or in the Bid Schedule. Maximum lengths of pipe shall not exceed 20 feet.

B. PVC pipe shown on the Drawings to be installed inside of structures or used to transport liquid or gaseous chlorine shall have threaded joints. Solvent welding of field joints will not be permitted. PVC for threaded joints shall be Schedule 80, National Sanitation Foundation approved and shall conform to the latest requirements of Commercial Standard CS 207 and ASTM D 1785 for Schedule 80 water pressure ratings. Pipe material shall be Type I, Grade 1, in accordance with the requirements of ASTM D 1784, Class 12454-B. Fittings shall comply with the requirements of ASTM D 2464 for molded, Schedule 80, screwed fittings.

C. When operating temperatures exceed 140°F, pipe material shall be chlorinated polyvinyl chloride (CPVC) in accordance with ASTM D 1784, Type IV, Grade 1, Class 23477-B.

2.3 FITTINGS

A. All fittings required in PVC piping systems conveying water or wastewater shall be cast iron or ductile iron as specified in Section 15062 of these Specifications. Engineering data for fittings showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. Connections between cast iron or ductile iron fittings and PVC pipe shall be made by use of special adaptors similar to Mueller Transition Gland A-399 by Mueller Co., Transition Gasket F6340 by Clow Corporation or a similar transition which has been approved by the Engineer. The joint shall be mechanical joint for ductile iron or cast iron as described in Section 15062 of these Specifications.

B. Fittings for PVC pipe inside of structures or used to convey liquid or gaseous chlorine shall comply with the requirements of ASTM D 2464 for Molded, Schedule 80, screwed fittings.

2.4 PVC VALVES AND STRAINERS

A. Unless otherwise shown or required, all valves, unions, and strainers in PVC piping shall be constructed of Type I, Grade 1 PVC. Valves shall be NSF approved and shall have a working pressure of 150 psi.

B. Ball valves shall have double union type body, Teflon seats, Viton seals, full diameter port, and NPT threaded ends. Ball valves in 4-inch size may have single union body.

C. Check valves shall be of the ball type with union body, Viton seat, and NPT threaded ends.

D. Strainers shall be of the wye type with NPT threaded ends and 8 or 10 mesh strainer basket.

2.5 JOINTS

A. Push-On Joints

1. The joints shall be designed so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be single rubber gasket joint designed to be assembled by the positioning of a continuous, molded, rubber ring gasket in an annular recess in the pipe or fitting entering pipe into the socket thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and the annular recess shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled. Details of the joint design and assembly shall be in accordance with the joint manufacturer's standard practice. The joints shall be designed so as to provide for the thermal expansion or contraction experienced with a total temperature change of at least 75°F in each joint per length of pipe. The joint shall comply with ASTM D 3139. Gasket shall comply with ASTM F 477.
2. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to water. The lubricant containers shall be labeled with the manufacturer's name.
3. Gaskets shall meet all applicable requirements of ANSI A21.11. Gasket dimensions shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to affect a positive seal under all combinations of joint and gasket tolerances. The trade name or trademark, size, mold number, gasket manufacturer's mark and year of manufacture shall be molded in the rubber on the back of the gaskets.
4. Gaskets shall be vulcanized natural or vulcanized synthetic rubber. No reclaimed rubber shall be used. When two hardnesses of rubber are included in a gasket, the soft and hard portions shall be integrally molded and joined in a strong vulcanized bond. They shall be free of porous areas, foreign material, and visible defects. The required properties of the gasket rubber and the required method of test are given in the following table:

ASTM Test Property	Method	Main Body of Gasket	Harder Portion (if used)
Hardness, Durometer "A"	D 676 at 76” 6°F	45-70	78-90
Minimum Ultimate Tensile, psi	D 412	2,000	1,200
Minimum Ultimate Elongation, Percent[1]	D 412	300	125
Minimum Aging, Percent[2]	D 572[3]	60	60

[1] Of original length.

[2] Of original values of tensile and ultimate elongation.

[3] Oxygen pressure method: After 96 hours at 70 "1°C at 300 +10 psi.

5. The gasket manufacturer shall set up such quality control procedures as will ensure the gasket's meeting the requirements of this standard. He shall furnish a monthly report of representative quality control test results to the pipe manufacturer.
6. A sample push-on fitting shall be submitted to the Engineer for examination and approval prior to delivery of any pipe.

B. Threaded Joints
1. Joints shall be made with American Standard IPS threads. All joints shall be made up with Teflon thread tape or thread dope or with pipe manufacturers recommended joint compound for use with chlorine solution.
2. All fittings shall be Schedule 80 with screwed joints. Gaskets for flange fittings and unions shall be as recommended by pipe manufacturer for use with chlorine solution.

PART 3 EXECUTION

3.1 LAYING PIPE

A. All provisions with respect to trenching, backfilling, bedding, and pipe laying shall conform to the applicable requirements of these Specifications.

B. All provisions with respect to connections and existing utilities shall comply with the applicable requirements of these Specifications.

C. Exposed piping shall be supported in accordance with the requirements of the section entitled "Pipe Supports and Hangers" of these Specifications. Metal valves and valve boxes shall be supported independently of piping. PVC piping shall be isolated from direct contact with metal or concrete supports by a 1/32-inch sheet of neoprene.

D. When a joint consists of a PVC flange and a metal flange, the metal flange shall be flat faced and furnished with a full face resilient gasket.

E. PVC valves shall be installed with the flow arrow in the proper direction. Union nuts on PVC valves shall be tightened only hand tight in accordance with manufacturer's instructions. Spare O-ring seals and seats shall be furnished with each PVC valve.

F. Where specifically shown or called for on the Drawings, service line taps into PVC pipe shall be made using tapping saddle constructed for use on PVC pipe. The saddle shall be constructed of bronze or brass, shall have all stainless steel bolts or screws, and have a resilient rubber gasket to provide a positive, watertight seal.

G. PVC pipe laid underground shall have a minimum of 36 inches of cover in traffic areas and 30 inches of cover in non-traffic areas.

3.2 FIELD TESTING

A. After all piping has been placed and backfilled between the joints, each run of newly laid pipe, or any valved section thereof, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.

B. All piping shall be subject to a hydrostatic gauge pressure equal to the rated pressure class of the pipe being tested. The allowable leakage shall be as shown in Table 1. The duration of the test shall be a minimum of 2 hours.

C. The Contractor shall take all precautions necessary to protect any equipment that might be damaged by the pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.

D. All piping shall be securely anchored and restrained against movement prior to application of test pressures. Prior to the pressure test, pipe laid in trenches shall be partially backfilled adequately to secure the pipe during the test. All joints, fittings, and valves will be left open where possible. All exposed pipe, fittings, valves, and joints shall be carefully examined during the pressure test.

E. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants, blow-off valves, or air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert plugs after the test has been completed.

F. Any excessive leakage developing during the test shall be corrected at the Contractor's expense. If the defective portion cannot be located, the Contractor, at his expense, shall remove and reconstruct as much of the original work as necessary to obtain a facility meeting the specified leakage limits.

G. After all tests on any section have been completed to the satisfaction of the Engineer, the Contractor shall carefully clean, blow out, and drain the line of all water to prevent the freezing of the same. The Contractor shall also demonstrate to the satisfaction of the Engineer that any and all lines are free from obstructions and foreign material.

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

I. All pipe used for gaseous chlorine shall be tested with ammonia solution as recommended by the manufacturer of the chlorination equipment.

TABLE 1

ALLOWABLE LEAKAGE
(U.S. Gallons per 100 Joints per Hour)

Pipe Diameter (inches)	Test Pressure (psi)			
50	50	100	150	200
4	0.35	0.50	0.60	0.75
6	0.53	0.75	0.90	1.10
8	0.70	1.00	1.20	1.40
10*	0.88	1.25	1.50	1.75
12*	1.05	1.50	1.80	2.10

*Single-gasket coupling is one joint. Twin-gasket coupling is two joints.

3.3

FIELD PAINTING

After installation, all exposed piping shall be field primed and painted in accordance with the requirements of these Specifications.

END OF SECTION

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SECTION 15064-B

PVC SEWER AND SERVICE PIPE

PART 1 GENERAL

1.1 SCOPE

The work covered by this section includes furnishing all labor, equipment, and materials required to install and test polyvinyl chloride (PVC) pipe, including accessories, as shown on the Drawings and/or specified herein.

1.2 QUALITY ASSURANCE

A. The Contractor, at the Engineer's request, shall furnish a certificate from the manufacturer of the pipe and fittings that the manufacturer is fully competent and capable of manufacturing PVC sewer pipe, fittings, and accessories of uniform texture and strength that will fully comply with these Specifications and have so manufactured this class of pipe in sufficient quantities to be certain that it will meet all normal field conditions of usage. The manufacturer must have adequate equipment and quality control facilities to be sure that each extrusion of pipe is uniform in texture, dimensions, and strength.

B. Pipe shall be tested when requested by the Engineer and all pipe so designated shall be tested in accordance with ASTM D 2412 "Standard Method of Test for External Loading Properties of Plastic Pipe by Parallel Plate Loading."

C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:
   1. Manufacturer's name
   2. Pipe size
   3. PVC compound used
   4. ASTM material specification for the PVC compound used

1.3 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Submittals" of these Specifications.

1.4 STORAGE AND PROTECTION

A. PVC piping and accessories shall be stored and protected in accordance with the requirements of the section entitled "Storage and Protection" of these Specifications.

B. PVC pipe and fittings shall be stored under black plastic cover.

C. All pipe and accessories shall be stored above ground and fully supported so as not to bend or deflect excessively under its own weight.

1.5 GUARANTEE

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

PART 2 PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. The pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

B. The manufacturer shall provide waterstops, acceptable to the Engineer, which shall be applied to the outside of the plastic pipe when the pipe is to be enclosed in any structure where concrete or mortar is used which will prevent leakage along the outer wall of the barrel of the pipe.

C. No single piece of pipe shall be laid on any project covered by this Specification unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed 1/16-inch per foot of length. If the deviation exceeds this requirement, then the particular piece of pipe shall be rejected from use until it can comply with this provision.

D. Wyes, tees, bends, adapters, and any other fittings required or directed by the Engineer shall be provided. Engineering data for such fittings showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. The materials used in the manufacture of fittings shall conform to the requirements for the pipe with which they shall be used and any variation of such requirements shall be subject to the approval of the Engineer. Fittings shall have wall thicknesses equal to or greater than that of the pipe to which they are joined.

2.2 PIPE

A. PVC piping and accessories shall be made from Virgin Type I, Grade 1 PVC compounds with physical and chemical properties conforming to those defined and described in ASTM D 1784 for "Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds."

B. The standard length of PVC pipe under this Specification shall be 20 feet with a minimum of 10 feet, except that all pipe used in service lines shall not exceed 10 feet in length unless otherwise approved by the Engineer.

C. The 4-inch through 15-inch PVC pipe and accessories shall be manufactured in accordance with ASTM D-3034, Type PSM (SDR 35 or less). The 18-inch through 27-inch PVC pipe and

accessories shall be manufactured in accordance with the requirements of ASTM F-679, polyvinyl chloride (PVC) large diameter plastic gravity sewer pipe and fittings.

2.3 JOINTS

A. PVC pipe joints shall be the bell and spigot type subject to the approval of the Engineer.

B. The pipe joints shall meet ASTM D-3212, latest revision, for joints for drain and sewer pipe using flexible elastomeric seals, and the seals shall meet standard ASTM F-477. All gaskets shall be factory installed and positively retained by means of a stainless steel, polypropylene or PVC ring. Factory installed glued gaskets will be acceptable; however, field-installed glued gaskets are not acceptable.

PART 3 EXECUTION

3.1 PIPE LAYING

A. Before sewer pipe is placed in position in the trench, the bottom and sides of the trench shall be carefully prepared and bracing and sheeting installed where required. A mason's line, supported at intervals not exceeding 50 feet, shall be stretched tightly above ground level at a grade parallel to and directly above the axis line of the pipe. Each pipe shall be accurately placed to the exact line and grade called for on the Drawings by measuring down from this line to the invert of the pipe in place. The Contractor shall furnish all labor and materials necessary for erecting batter boards and establishing lines and grades therefor.

B. The Contractor may use the laser beam method of setting a line and grade for the sewer by using the laser beam coaxially through the center of the sewer being laid. The laser beam projector is to be rigidly mounted to its support platforms, with a two-point suspension, or equivalent, assuring that all ground and equipment vibrations are kept to an absolute minimum. All equipment including equipment necessary to control atmospheric conditions in the pipe to keep line and grade to acceptable standards of accuracy shall be furnished by the Contractor. The laser beam system must be operated by competent experienced men who have been properly trained to operate the equipment used.

C. The Contractor shall stake check pegs at all manholes throughout the job. Check pegs midway between manholes and any other check points deemed necessary to assure accuracy of the equipment shall be provided by the Contractor.

D. Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells uphill. No pipe shall be laid except in the presence of an inspector representing the Engineer. Trench bottoms found to be unsuitable for foundations after pipe laying operations have started shall be corrected and brought to exact line and grade with approved compacted materials.

E. Bell holes shall be of sufficient size to allow ample room for making the pipe joints properly. Bell holes shall not be cut out more than ten joints ahead of pipe laying. The bottom of the

trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length as shown on the Drawings. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe in order to avoid sudden offsets or inequalities in the flow line.

F. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completely set or before the trench has been backfilled. The Contractor at no time shall open up more trench than his available pumping facilities are able to dewater. Where sewer pipelines are located in or across stream beds or drainage ditches, the Contractor shall divert the stream flow and dewater each section as the work progresses.

G. No joints shall be made where pipe or joint materials have been soiled by earth in handling until such soiled surfaces are thoroughly cleaned by wire brushing and wiping until all traces of the earth are removed.

H. As the work progresses, the interior of all pipe shall be kept thoroughly clean. After each line of pipe has been laid, it shall be carefully inspected and all earth, trash, rags, and other foreign matter removed from the interior. A filled bag or other approved type of follower shall be pulled through the line immediately after each joint is made in order to remove any debris which may be left on the inside of the pipe.

I. Backfilling of trenches shall be started immediately after the pipe in place has been inspected and approved by the Engineer and backfill shall be deposited and compacted as provided under the section entitled "Earthwork" of these Specifications.

J. Installation of service pipe shall conform to the appropriate requirements of main line sewers.

K. Connections of service lines to the main sewer shall be made with bends of the proper degree to make the service run perpendicular to the main sewer. Pipe shall be laid to a uniform line and grade. Minimum grade shall be 1 percent.

L. The end of all service connections shall be plugged with a PVC plug and sealed with plastic joint material.

M. Crushed stone bedding and backfill material, concrete encasement and protection, etc., for service line installation shall be provided as conditions require and as directed by the Engineer.

N. No service connections shall be covered until they have been inspected and located by the Engineer.

3.2 INSTALLATION OF TEES, RISERS, AND PLUGGED STUBS

A. Tee branches shall be installed in the sewer lines at all places shown on the Drawings, specified herein or otherwise directed by the Engineer. Tee branches on pipe less than 12 inches in diameter shall be cast or extruded and manufactured monolithic with the barrel.

B. Riser connections, of the size and type shown on the Drawings shall be installed at the locations shown on the Drawings or directed by the Engineer. A plastic film marking tape 5 feet long shall be placed 12 inches over the top of each riser during backfilling to mark the location of the riser. The marking tape shall be heavy gauge polyethylene film (.004 inch thick). Tape shall be standard red color imprinted with the words "Warning - Buried Sewer Line Below." Tape shall be Allen Marking Tape No. AMT-1212 as manufactured by the Allen System Inc., Glen Ellyn, Illinois, or equal. A second marking tape containing a metallic core which shall be located with a metal detector shall be laid on top of the first marking tape. This tape shall be 5 feet long and 3 inches wide. Tape shall be Allen Detectotape Catalogue No. ADT-1003 for buried sewer line as manufactured by the Allen System Inc., or equal.

C. Plugged pipe stubs for future connections to manholes and sewerage structures shall be installed where shown on the Drawings or directed by the Engineer. The pipe stubs shall be installed with the bell encased in the wall of the manhole and the bell opening flush with the outside wall of the manhole or structure.

D. Plugged stubs and such branches of pipelines that are not to be used immediately shall be closed with PVC stoppers held securely in place.

E. Where specifically directed by the Engineer or shown on the Drawings, connections to reinforced concrete pipe over 18 inches in diameter shall be made in accordance with details shown on the Drawings.

3.3 CONNECTIONS

A. If the work consists of the construction of a sewer that is to replace an existing sewer, all of the existing service lines shall be kept in operation and connected to the new line.

B. Connections shall be made to all existing sewer lines in the vicinity of the work by removing a section of the sewer from the existing line and inserting in the space a tee branch of proper size, or by the construction of a manhole, regulator chamber or other structure as shown on the Drawings.

C. Connections to existing manholes or inlets where no plugged stubs exist shall be made by cutting a hole in the wall of the existing structure, inserting a length of sewer pipe into the hole, filling around same with concrete or mortar and trowelling the inside and outside surfaces of the joint to a neat finish. The bottom of the manhole shall be shaped to fit the invert of the sewer pipe as specified in these Specifications.

D. Connections to building services shall be made in a neat and workmanlike manner. Cleanout plugs shall be installed, wherever feasible, by making the connections with a standard wye or tee.

3.4 EXISTING UTILITIES

A. All existing sewers, water lines, gas lines, underground conduits, telephone lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the

work shall be carefully protected by the Contractor from damage at all times. Where it is necessary for the proper accomplishment of the work to repair, remove and/or replace any such utility, the work shall be done under the provisions set forth in the "General Conditions." No separate payment shall be made for removing and replacing and/or repairing damaged existing sewers; water, gas, electric, telephone lines or conduits; or other utilities, culverts, drains, or conduits of similar existing services or structures. Similar repair and replacement of sidewalks, curbs, gutters, and pavements are provided elsewhere in these Specifications.

B. Sewers to be installed parallel to any existing or proposed water main shall be laid at least 10 feet, horizontally, from the water main. If conditions prevent the 10-foot separation, the sewer may be constructed closer to a water main if it is laid in a separate trench and if the bottom of the water main is at least 18 inches above the top of the sewer.

C. When sewers cross under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If necessary, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint ductile iron pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.

D. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both water main and sewer shall be constructed of mechanical-joint ductile iron pipe and shall be pressure tested to assure water tightness.

E. When sewer lines cross under culverts where the sewer and the culvert are less than 18 inches apart, the sewer line shall be encased in concrete as shown on the Standard Drawings.

3.5 INSPECTION AND TESTING

A. After completion of any section of sewer, the grades, joints, and alignment shall be true to line and grade. Joint surfaces shall be smooth. There shall be no visual leakage and the sewer shall be completely free from any cracks and from protruding joint materials, deposits of sand, mortar, or other materials on the inside.

B. One hundred percent of all PVC pipe 8 inches in diameter and greater shall be deflection tested. The maximum allowable deflection for PVC is 5 percent. After the PVC pipe has been installed and backfilled, the Contractor shall check the deflection by pulling a vertical floating pin type go/no go mandrel sized at 95 percent of the actual inside diameter of the pipe used through the pipe. Deflection tests shall not be conducted before the elapse of 24 hours after backfilling. Any pipe not passing the mandrel shall be replaced and rechecked.

C. Infiltration shall not exceed 25 gallons per 24 hours per inch of diameter per mile of sewer. Contractor shall furnish all supplies, materials, labor, services, etc., needed to make infiltration or exfiltration tests including water. No separate payment will be made for equipment, supplies, material, water, or services.

D. Any leakage, including active seepage, shall be corrected by removal and replacement of pipe or joint where such leakage exists until the pipelines meet the requirements of the allowable leakage specifications.

E. All sewer pipe shall be tested using low pressure air testing in accordance with the procedures and standards listed below.

F. Clean pipe to be tested by propelling snug-fitting inflated rubber ball through pipe with water.

G. Plug all pipe outlets with suitable test plugs. Brace each plug securely to prevent blowouts. As a safety precaution, pressurizing equipment shall include a regulator set at slightly above test pressure to avoid overpressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manhole during testing.
   1. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any groundwater above the pipe (0.43 psi per foot of groundwater above the pipe invert), but not greater than 9.0 psig.
   2. After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure
   3. When pressure is decreased to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 3.0 psig. Minimum permissible holding times for runs of single pipe diameter are indicated in the table in seconds. No separate allowance shall be given for laterals

Specification Time Required for a 0.5 Psig Pressure Drop
For Size and Length of Pipe Indicated

Min. Pipe Diameter	Min. Time (min.: sec.)	Length for Min. Time	Time for Longer Length	Specification Time for Length (L) Shown (min:sec)							
				100	150	200	250	300	350	400	450
(in.)	sec.)	(ft.)	(sec.)	Feet	feet	feet	feet	feet	feet	feet	feet
8	3:47	298		3:47	3:47	3:47	3:47	3:48	4:26		
10	4:43	239		4:43	4:43	4:43	4:57	5:56	6:55		
12	5:40	199		5:40	5:40	5:42	7:08	8:33	9:58		
15	7:05	159		7:05	7:05	8:54	11:08	13:21	15:35		
18	8:30	133		8:30	9:37	12:49	16:01	19:14	22:26	25:38	
21	9:55	114		9:55	13:05	17:27	21:49	26:11	30:32	34:54	
24	11:20	99	6.837xL	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653xL	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683xL	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926xL	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384xL	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

3.6 CLEANUP

A. After completing each section of the sewer line, the Contractor shall remove all debris, construction materials, and equipment from the site of the work, grade and smooth over the surface on both sides of the line and leave the entire right-of-way in a clean and neat condition. Unless otherwise called for on the Drawings, the Contractor shall restore all disturbed areas to as close to its original condition as possible. Restoration shall include but not be limited to grassing, replacing shrubbery, trees, fences and other improvements that have been disturbed.

B. Cleanup and restoration shall be completed within 60 calendar days after each section of sewer line is installed. Should the Contractor fail to do the cleanup within 60 calendar days, payment made for pipe sewers and service lines for that section of the sewer not cleaned up shall be removed from the periodic estimate until the cleanup work is completed.

END OF SECTION

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SECTION 15090

PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 GENERAL

1.1 SCOPE

The work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install pipe couplings and expansion joints, including grooved couplings, flanged adaptors, expansion couplings, and rubber expansion joints, as shown on the Drawings, specified herein, and/or required for proper installation of piping and equipment.

1.2 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Submittals" of these Specifications.

1.3 STORAGE AND PROTECTION

Pipe couplings shall be stored and protected in accordance with the requirements of these Specifications.

1.4 SHOP PAINTING

Pipe couplings shall be cleaned, shop primed, and shop painted as specified herein.

1.5 GUARANTEE

Provide a guarantee against defective materials and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

PART 2 PRODUCTS

2.1 EXPANSION COUPLINGS

A. Unless otherwise shown or specified, expansion couplings shall be of a gasketed, short sleeve type, with a diameter to fit the pipe properly. Expansion couplings shall have a working pressure of not less than 150 PSIG.

B. Each short sleeve coupling for joining cast iron or ductile iron pipe shall consist of one cylindrical cast iron middle ring without pipe stop, two high-grade malleable iron or steel followers, two rubber compound, wedge section gaskets, and a sufficient number of track head, electroplated steel bolts to compress the gaskets properly. Cast iron couplings shall be Dresser Style 53, Rockwell Style 441, or equal.

C. Each short sleeve coupling for joining steel pipe shall consist of one cylindrical steel middle ring without pipe stop, two steel follower rings, two rubber-compound, wedge section gaskets, and a sufficient number of track head, electroplated steel bolts to compress the gaskets properly. Steel couplings shall be Dresser Style 38, Rockwell Style 411, or equal.

D. Where expansion couplings are required for joining cast iron pipe to steel pipe of the same nominal size, steel transition couplings, Dresser Style 62, Rockwell Style 413, or equal, shall be used.

E. Rubber gaskets shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.

2.2 GROOVED COUPLINGS

A. Grooved couplings for cast iron and ductile iron pipe shall consist of two or more ductile iron housing clamps, a single rubber compound gasket, and electroplated oval-neck track bolts with heavy hex nuts. Housing shall be ribbed for strength and self-centering. Rubber gasket shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.

B. Grooved couplings shall provide for a pipe end separation of not less than 3/32-inch and a deflection of not less than 0°45'.

C. Grooved couplings shall engage two circumferential grooves cut at the ends of the pipe sections to be joined. The grooves shall provide a positive mechanical grip that locks the pipe ends together such that they cannot blow apart under pressure, vibration, or sag. Grooves shall be cut with a radius at the inside corners of the grooves.

D. Grooved couplings for joining cast iron or ductile iron pipe shall be Vitraulic Style 31, Gustin-Bacon Gruvajoint No. 500, or equal.

2.3 FLANGED ADAPTORS

A. Flanged adaptors shall be used for joining plain end cast iron or ductile iron pipe to flanged valves, pumps, and fittings. Flanged adaptors shall be suitable for working pressures to 150 PSIG.

B. Flanged adaptors in sizes 12-inch and smaller shall consist of an ASTM A 126, Class B cast iron flanged body drilled to mate with a 125-pound cast iron flange per ANSI B16.1, a cast iron follower ring, a rubber-compound, wedge section gasket, and a sufficient number of track head, electroplated steel bolts to compress the gasket properly.

C. Flanged adaptors in sizes 14-inch and larger shall consist of a high strength steel flanged body drilled to mate with a 125-pound cast iron flange per ANSI B16.1, a high strength steel follower ring, a rubber-compound, wedge section gasket, and a sufficient number of electroplated steel bolts to compress the gasket properly.

D. Rubber gasket shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.

2.4 FLANGED RUBBER EXPANSION JOINTS

A. Flanged rubber expansion joints shall be standard spool-type single or multiple arch expansion joints constructed of abrasion resistant rubber reinforced with high tensile strength synthetic fabric and steel rings.

B. Ends of the expansion joint shall be integral with the body and shall be full faced and drilled per ANSI B16.1 for 125-pound flanges. Beveled and split, galvanized steel retaining rings shall be provided to prevent damage to flanges and to distribute bolting stresses during assembly.

C. Tube, body, and flanges shall be constructed using Buna-N for wastewater, natural rubber for clean water, and Buna-N or neoprene for air. For working temperatures in excess of 180°F or for chemical service, tube, body, and flanges shall be constructed of Viton. The exterior of the expansion joint shall be coated with Hypalon to resist weathering.

D. When used to convey slurries, raw water, or untreated wastewater in horizontal piping, arches shall be filled with a special soft rubber compound integrally cured in the arches.

E. In unrestrained piping systems or pipe systems subject to excessive longitudinal deflection, joints shall be furnished with two plated steel control rods filled with nuts to limit compression and extension and prevent damage to the joint.

F. Rubber expansion joints shall be "Redflex," as manufactured by Red Valve Company, "Invincible Expansion Joint," as manufactured by Mercer Rubber Company, or equal, subject to the requirements of this section.

2.5 SLIP-ON RUBBER EXPANSION JOINTS

Slip-on rubber expansion joints for low pressure applications (less than 15 PSIG) up through 6-inch-diameter in size shall be sleeve-type, single-arch expansion joints constructed of abrasion resistant rubber reinforced with high tensile strength synthetic fabric.

A. Ends of the joint shall be designed to slip over pipe ends and shall be secured in place with adjustable stainless steel clamps. Two clamps shall be provided on each end of the joint.

B. Joint shall be constructed of Buna-N for wastewater and Buna-N or neoprene for air at working temperatures up to 180°F.

2.6 SHOP COATINGS

A. Couplings and adaptors shall have finish as follows:

Material	Location	Primer	Finish
Cast Iron	Buried or Submerged	Asphaltic Varnish Inside and Out	
Cast Iron	Exposed	Asphaltic Varnish (Interior)	
Cast Iron	Exposed	Primer (Exterior)	(Field Applied)
Steel	Buried or Submerged	Epoxy Primer Inside and Out	Coal Tar Epoxy
Steel	Exposed	Primer (Exterior)	(Field Applied)
Steel	Exposed	Epoxy Primer (Interior)	Coal Tar Epoxy (Interior)

B. Coatings used for couplings and adaptors in potable water shall be approved for use with potable water.

2.7 SPARE PARTS

The Contractor shall furnish two spare gasket sets and two spare track head bolt sets for each size and type of coupling.

PART 3 EXECUTION

3.1 INSTALLATION

A. Pipe couplings and expansion joints shall be installed where shown on the Drawings, required, or directed by the Engineer. Couplings and joints shall be installed in strict conformance with the manufacturer's instructions.

B. Pipe ends shall be cleaned, brushed, or filed to produce a mating surface for the gasket that is free from dirt, rust, chuck marks, mill scores, dents, burrs or other foreign substances that would impede proper gasket seating.

C. Grooves for grooved couplings shall be accurately located and cut with a suitable grooving tool.

D. A lubricant recommended by the coupling manufacturer shall be used in seating all gaskets.

E. On expansion couplings and flanged adaptors, bolts shall be tightened diametrically opposite each other and in progression so that the inner rims project an equal distance over the flares of the middle ring at all points. Bolts shall be tightened sufficiently to ensure a watertight joint but shall not be tightened beyond the point of stretching.

F. On grooved couplings, bolts shall be tightened alternately and uniformly so the housing clamps come together evenly and the gasket is not pinched. Bolts shall be tightened until the housing clamps meet.

G. Following installation and testing, couplings shall be field painted in accordance with the requirements of these specifications. Rubber expansion joints shall not be painted.

END OF SECTION

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SECTION 15095

PIPE SUPPORTS AND HANGERS

PART 1 GENERAL

1.1 DESCRIPTION

This section covers all pipe supports, hangers, and brackets necessary to install piping furnished under these Contract Documents. The Contractor shall furnish and install all foundations, anchor bolts, pipe supports, shims, hangers, clamps, and hardware required for a complete installation as shown on the Drawings and/or specified herein.

1.2 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Submittals" of these Specifications.

1.3 STORAGE AND PROTECTION

Pipe supports and accessories shall be stored and protected in accordance with the requirements of these Specifications.

1.4 SHOP PAINTING

Fabricated pipe supports and accessories not specified to be galvanized or cadmium plated shall be cleaned and shop primed in accordance with the requirements of these Specifications.

1.5 GUARANTEE

Provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

PART 2 PRODUCTS

2.1 MATERIALS

All supports and hangers shall meet the following material requirements:

A. All structural steel shall conform to ASTM A 36.

B. All pipe support columns shall conform to ASTM A 53, Grade B, and shall be minimum Schedule 40.

C. All embedded anchor bolt materials shall conform to ASTM A 193, Grade B8; ASTM A 276, Type 304; or IFI-104, Grade 304. Nuts shall be heavy hex nuts conforming to ASTM A 194, Grade 8 or IFI-104, Grade 304. Minimum anchor bolt size for pipe supports shall be 5/8-inch diameter.

D. All rod and bolting materials in contact with cold piping (less than -20E F) shall conform to ASTM A 320, Grade B8. Nuts shall be heavy hex nuts conforming to ASTM A 194, Grade 8 or 8T.

E. All rod and bolting materials shall conform to ASTM A 307, Grade B, and shall be cadmium plated. Nuts shall be heavy hex nuts conforming to ASTM A 307. Cadmium plating shall conform to ASTM A 165, Type NS.

F. All carbon steel or malleable iron straps, hangers, clamps, U-bolts, and other hardware in contact with the pipe shall be cadmium plated or hot-dip galvanized.

G. Expansion type anchor bolts shall be of stainless steel construction and shall comply with Federal Specification FF-S-325.

H. Long runs of pipe subject to expansion shall be hung by means of adjustable swivel pipe roll hangers, Grinnell, Figure 174; Fee and Mason, Figure 2729; or equal.

I. Short runs of uninsulated pipe subject to expansion in sizes up to and including 3-1/2 inches as well as all pipe of those sizes not subject to expansion shall be hung by means of adjustable swivel, split pipe ring, Grinnell, Figure 104; Fee and Mason, Figure 199; or equal.

J. Insulated piping and tubing, short lengths of 4-inch and larger pipe subject to expansion, and pipe 4 inches and larger not subject to expansion shall be hung by means of adjustable steel clevis hangers, Grinnell, Figure 260; Fee and Mason, Figure 239; or equal.

K. Pipe 2 inches and less in diameter and not subject to expansion may, when paralleling walls, be supported by single hook clamp hangers, Grinnell, Figure 168; Fee and Mason, Figure 327B, or equal.

L. Flat strap hangers will not be permitted. Hangers relying on mastics or adhesives shall not be used.

M. Pipe supported from underneath and subject to expansion shall have adjustable pipe roll stand supports, Grinnell, Figure 274; Fee and Mason, Figure 161; or equal. The pipe roll stand shall be supported by concrete piers, structural steel, or steel brackets as required.

N. Pipe supported from underneath and not subject to expansion shall have cast-in-place concrete supports as shown on the Drawings or adjustable pipe saddle supports on properly sized pipe stanchions and ample, properly grouted floor flanges. Saddle supports shall be Grinnell, Figure 264; Fee and Mason, Figure 291; or equal.

O. Hangers suspended from structural steel shall be supported on U. F. S. beam clamp, Grinnell, Figure 228L or 2921; Fee and Mason, Figure 252L or 253L; or equal with links as required.

P. Hangers from concrete work shall be secured by universal, galvanized metal inserts, Grinnell, Figure 282; Fee and Mason, Figure 2570; or equal, placed in the concrete at the time of pouring. Wooden plugs or other improvised means shall not be used for any form of hanger fastening.

Q. Steel or concrete pipe supports for all piping between undisturbed earth and face of structures shall be in accordance with the details shown on the Drawings.

R. All interior and exterior concrete piers shall be Class A concrete meeting the requirements of these Specifications.

S. Rods for supporting suction bells or foot valves of pump intakes shall be stainless steel of the size shown on the Drawings. The rods shall be furnished complete with stainless steel turnbuckles and eyes or other approved means for connection to the suction bell and stainless steel eye bolt anchored in the concrete. Supports for other pump suction pipelines shall be as shown on the Drawings.

T. Uninsulated copper tubing shall be hung by means of copper-plated, split- ring hangers with copper-plated sockets, Grinnell Figure CT-109, Fee and Mason Figure 360, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Contact between ferrous supports and non-ferrous piping materials shall not be permitted. Supports and clamps shall be rubber coated or copper plated as necessary to prevent this condition.

B. Adequate supports shall be provided so that there is no movement or visible sagging between supports.

C. Hangers shall permit a minimum of $1^{1}/_{2}$-inch vertical adjustment after installation.

D. Hanger rods shall be galvanized carbon steel conforming to the following sizes:

Minimum Rod Diameter, In.	
1/2 and under	
$^{3}/_{4}$-2	3/8
$2\ ^{1}/_{2}$ - $3\ ^{1}/_{2}$	$^{1}/_{2}$
4	5/8
6	$^{3}/_{4}$
8-12	7/8

E. Carbon steel, alloy steel, stainless steel, and hard-drawn copper pipe shall be supported on maximum intervals as follows:

Maximum Interval for Steel (feet)	Maximum Interval	Pipe Size (inches)	Liquid Gas for Copper (feet)
1/2	5	6	4
3/4	6	7	5
1	7	9	6
1 1/2	9	11	8
2	10	13	8
2 1/2	11	14	9
3	12	15	10
4	13	17	11
6	17	21	--
8	19	24	--
10	22	27	--
12	23	29	--
14	25	32	--
16	27	35	--
18	28	37	--
20	30	39	--
24	32	42	--

F. Annealed copper tubing, polyethylene tubing, and PVC piping shall be supported on maximum intervals as follows:

Tube Size (inches)	Maximum Interval (feet)
3/8 and smaller	2
1/2 - 5/8	3
3/4 - 1-1/8	4
1-1/4 - 2	5
2-1/2 - 3-1/2	6
4	7
6	8

G. Where indicated or directed by the Engineer, exposed piping and tubing carrying liquid shall be sloped as necessary to permit complete draining. Pipe deflection between supports shall be considered when determining the slope required to permit complete drainage. All underground piping shall be sloped uniformly for complete drainage.

H. Cast iron or ductile iron piping shall be supported as recommended by the manufacturer, and at all valves and fittings larger than 4 inches in size. At least one support shall be provided per pipe section or at every other joint, whichever is closer. Supports shall be located next to hubs or bells.

I. Open ends of pipe columns used for support shall be completely covered with a $^{1}/_{4}$-inch-thick plate or angle leg welded in place.

J. All threaded connections installed loose, such as hanger rods and U-bolts, shall have a double nut installation.

K. Vertical piping shall be supported as shown or required to prevent buckling or swaying utilizing special brackets. Unless otherwise shown, vertical piping shall be supported at the bottom and at each floor. Vertical copper tubing one inch and smaller in size shall be supported at 5-foot intervals.

L. Provide a support within 18 inches of each elbow and within 24-inches of each equipment connection.

M. Pipes passing through non-load bearing walls and partitions shall not bear on building construction. Pipes shall not be supported from roof decking, bar joists, or ceiling suspension systems unless approved by the Engineer.

N. Insulation on hot piping (carrying fluids above 70°F) shall be protected at supports and hangers with a 12-inch-long galvanized steel protection saddle with welded center support. Protection saddle shall be Grinnell Figure 160 or 161, Fee and Mason Figure 171 or 1710, or equal.

O. Insulation on cold piping (carrying fluids at 70°F or below) shall be protected at supports and hangers by galvanized steel insulation shields with a 180-degree contour. Insulation shields shall be Grinnel Figure 167, Fee and Mason Figure 81, or equal.

P. On insulation finished with an aluminum jacket, a 1/32-inch-thick sheet of neoprene shall be provided between the jacket and the shield.

Q. Hangers shall be selected to fit around insulation.

R. Following installation, all pipe supports shall be field primed and painted with the specified painting system for the application in accordance with requirements of these Specifications.

S. Unless otherwise shown, piping shall not be fastened to a support in such a manner than would prevent axial movement due to thermal expansion and contraction.

T. No pipe supports shall be anchored to or supported from floor grating.

U. Unless otherwise noted, piping dimensions shown on the Drawings are for reference only and shall be verified in the field by the Contractor. The Contractor shall size supports and hangers using actual field dimensions.

END OF SECTION