PROJECT MANUAL
FOR
CR 136/I-75 WASTEWATER TREATMENT PLANT
VOLUME II

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## Table of Contents

**SECTION 01000** SUMMARY OF WORK ................................................................. 1
**SECTION 01090** STANDARD REFERENCES .......................................................... 4
**SECTION 01330** SUBMITTAL PROCEDURES ......................................................... 8
**SECTION 01500** TEMPORARY CONSTRUCTION FACILITIES .................................. 20
**SECTION 01780** CLOSEOUT SUBMITTALS ............................................................ 24
**SECTION 01781** OPERATION AND MAINTENANCE ............................................... 31
**SECTION 01810** EQUIPMENT AND FACILITY STARTUP ....................................... 39
**UNIT PROCESS STARTUP FORM** ....................................................................... 44
**FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM** ............. 45
**SECTION 02140** DEWATERING ........................................................................... 46
**SECTION 02222** EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES .... 48
**SECTION 02300** EARTHWORK ............................................................................ 52
**SECTION 02450** GENERAL RESTORATION ......................................................... 62
**SECTION 02570** SEWAGE FORCE MAINS ............................................................. 64
**SECTION 02592** VALVE BOXES ........................................................................... 74
**SECTION 02823** SEEDING AND MULCHING ......................................................... 76
**SECTION 03100** CONCRETE WORK-GENERAL ................................................. 79
**SECTION 03200** CONCRETE REINFORCEMENT ................................................. 89
**SECTION 09800** PAINTING AND COATING .......................................................... 91
**SECTION 11000** PACKAGED WASTEWATER TREATMENT PLANT ................... 102
**SECTION 13000** POLYURETHANE RAPID DRAINING SLUDGE FILTER BED SYSTEM .... 129
**SECTION 13120** PRECAST CONCRETE BUILDING PRE-ASSEMBLED ................. 133
**SECTION 15051** BURIED PIPING INSTALLATION .............................................. 137
**SECTION 15062** INTERIOR AND EXPOSED PIPING .......................................... 144
**SECTION 09900** PAINTING ................................................................................ 174
SECTION 01000
SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1. SUMMARY:

This Section describes the Project in general and provides an overview of the extent of the Work to be performed.

Detailed requirements and extent of Work are stated in the applicable Specification Sections and are shown on the Drawings.

Except as otherwise specifically stated herein or in applicable parts of the Contract Documents provide and pay for labor, materials, equipment, tools, construction equipment, and other facilities and services necessary for proper execution and completion of the Work.

1.1.2. PROJECT DESCRIPTION:

The OWNER has decided to provide wastewater services to a Planning Area along CR-136/I-75 interchange to support economic development within the County. The project being bid is titled: “CR 136/I-75 Wastewater Treatment Plant”, prepared for the Suwannee County Board of County Commissioners in Suwannee County, Florida.

The Project is located on approximately 16 acres of County owned land located approximately .50 miles east of I-75 on the south side of SR-136.

The work to be performed under this contract will provide a wastewater treatment facility to treat the sewage generated within the Planning area and shall include but not be limited to the following components:

- A new Class one 50,000-gpd wastewater treatment plant.
- Propane fired backup power engine generator with auto transfer switch.
- Mechanical/electrical building
- Associated site work, concrete work, miscellaneous metals work and electrical work.

1.2 LOCATION OF UNDERGROUND FACILITIES

Contractor shall perform work in accordance with Florida Statute, chapter 556.105, “Underground Facility Protection and Safety Act”.

1.3 NOTIFICATION PRIOR TO EXCAVATION

Notify the Engineer at least 72 hours prior to starting excavation work. Contractor shall mark all utilities not marked by the utility company.
1.4 USE OF PREMISES

Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the work is indicated.

Allow for Owner occupancy and use by the public at Driveways and Entrances: Keep driveways and entrances serving the premises clear and available at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.5 WORK UNDER OTHER CONTRACTS

Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.6 OCCUPANCY REQUIREMENTS

Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1.7 CONTRACTOR USE OF SITE

OWNER may require screening of Contractor’s personnel and any subcontractor personnel prior to allowing access to the project site.

Contractor, and subcontractors, shall strictly adhere to OWNER’s designated security procedures including but not limited to identification badges.

Work performed outside of normal work schedules shall be coordinated with the OWNER and Engineer.

Saturday work, during daylight hours, requires prior approval from the OWNER and Engineer.

1.8 CONSTRUCTION SEQUENCING

The Contractor shall be solely responsible for construction means, controls, techniques, sequences, procedures, and construction safety in accordance with the Contract Documents.

Contractor shall coordinate with OWNER and Engineer in developing a sequence for construction activities.

1.9 MONTHLY STATUS MEETING

Contractor shall be required to attend a Monthly Status Meeting at the County Administrator’s office conference room. Attendees shall include: Contractor’s Project Manager, Contractor’s Site Superintendent, Consultant Project Manager, Consultant Inspector, and County Administrator.

- Contractor shall present a written Status Report identifying all Submittals.
• Contractor shall present a written Status Report identifying all Requests for Information.

• Contractor shall present a written Status Report on activities completed for the prior month, and activities planned for the next month.

• Contractor shall present a schedule clearly showing the work completed and the work remaining.

• Contractor shall take notes of each meeting and submit to Engineer for review within 5 days of meeting.

2.0 PROJECT SIGN

Contractor shall prepare and erect a Project Sign as described herein.

• Project Sign shall identify the OWNER, Contractor and Engineer. Submit layout to Engineer for approval. Use a professional sign painter to develop required Project Sign. Minimum size: 8' wide x 4' tall.

• Grant agency shall provide a separate funding agency sign for the project.

• Erect Project Signs at the locations designated by the Owner.

PART 2 - PRODUCTS (This part does not apply)

PART 3 - EXECUTION (This part does not apply)

END OF SECTION
SECTION 01090

STANDARD REFERENCES

Whenever used in the Project Manual, the following abbreviations will have the meanings listed:

AASHTO American Association of State Highway and Transportation Officials
444 North Capitol Street NW, Suite 255
Washington, DC 20001

ACI American Concrete Institute
Post Office Box 19150
Detroit, MI

AISC American Institute of Steel Construction
101 Park Avenue
New York, NY 10017

AISI American Iron and Steel Institute
150 East 42nd Street
New York, NY 10017

AITC American Institute of Timber Construction
333 West Hampden Avenue
Englewood, CO 80110

ANSI American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018

APA American Plywood Association
1119 A Street
Tacoma, WA 98401

API American Petroleum Institute
1801 K Street N.W.
Washington, DC 20006

ASCE American Society of Civil Engineers
345 East 47th Street
New York, NY 10017

ASCII American Standard Code for Information Interchange
United States of American Standards Institute
10 East 40th Street
New York, NY 10016

ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
United Engineering Center
345 East 47th Street
New York, NY 10017
ASME  American Society of Mechanical Engineers
      345 East 47th Street
      New York, NY 10017

ASTM  American Society for Testing and Materials
      1916 Race Street
      Philadelphia, PA 19103

AWPA  American Wood Preservers Association
      1625 Eye Street
      Washington, DC 20006

AWS   American Welding Society
      2501 N.W. 7th Street
      Miami, FL 33125

AWWA  American Water Works Association
      6666 N. Quincy Avenue
      Denver, CO 80235

CRSI  Concrete Reinforcing Steel Institute
      180 North La Salle Street
      Chicago, IL 60601

EEI   Edison Electric Institute
      90 Park Avenue
      New York, NY 10016

EIA   Electronic Industries Association
      2001 Eye Street N.W.
      Washington, DC 20006

ENGINEER  North Florida Professional Services, Inc.
          P.O. Box 3823
          Lake City, FL 32056

FEDSPEC  Federal Specifications
         General Services Administration
         Specification and Consumer Information
         Distribution Branch
         Washington Navy Yard, Bldg. 197
         Washington, DC 20407

FEDSTDS  Federal Standards
         (see FEDSPECS)

HI    Hydraulic Institute
      1230 Keith Building
      Cleveland, OH 44115

ICEA  Insulated Cable Engineers Association
      P.O. Box P
      South Yarmouth, MA 02664
IEEE Institute of Electrical and Electronic Engineers, Inc.
345 East 47th Street
New York, NY 10017

IES Illuminating Engineering Society
c/o United Engineering Center
345 East 47th Street
New York, NY 10017

ISA Instrument Society of America
400 Stanwix Street
Pittsburgh, PA 15222

MILSPEC Military Specifications
Navy Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

NAAMM National Association of Architectural Metal Manufacturers
100 South Marion Street
Oak Park, IL 60302

NACE National Association of Corrosion Engineers
Post Office Box 986
Katy, TX 77450

NEC National Electrical Code
National Fire Protection Association
470 Atlantic Avenue
Boston, MA 02210

NEMA National Electrical Manufacturer's Association
155 East 44th Street
New York, NY 10017

NFPA National Forest Products Association
1619 Massachusetts Avenue, N.W.
Washington, DC 20036

NFPA National Fire Protection Association
470 Atlantic Avenue
Boston, MA 02210

NSF National Sanitation Foundation
3475 Plymouth Road
Ann Arbor, MI 48106

OSHA Occupational Safety and Health Act
Occupational/Safety and Health Administration
Lubbock Area Office
1205 Texas Avenue, Room 421
Lubbock, TX 79401
OWNER
Suwannee County
Suwannee County Board of County Commissioners
131650 80th Terrace
Live Oak, FL 32060

SBCC
Southern Building Code Congress
1116 Brown-Marx Building
Birmingham, AL 35203

SSPC
Steel Structures Painting Council
4516 Henry Street, Suite 301
Pittsburgh, PA 15123-3728

SRWMD
Suwannee River Water Management District

CWSRF
Florida Clean Water State Revolving fund

FDEP
Florida Department of Environmental Protection

FDOT
Florida Department of Transportation

UBC
Uniform Building Code
Published by ICB

UL
Underwriters Laboratories, Inc.
207 East Ohio Street
Chicago, IL 60611

UMC
Uniform Mechanical Code
Published by ICBO

UPC
Uniform Plumbing Code
Published by IAPMO

USBR
Bureau of Reclamation
U.S. Department of Interior
Engineering and Research Center
Denver Federal Center, Building 67
Denver, CO 80225

USDA
U.S. Department of Agriculture

END OF SECTION
SECTION 01330

SUBMITTAL PROCEDURES

PART 1 - GENERAL

Required submittals shall be as designated in the individual specification sections and on the drawings. Submittals shall be in accordance with this section.

1.1 DEFINITIONS

Submittals:

Submittals shall include administrative documents, schedules, planning documents, Shop Drawings, Samples as described in the Standard General Condition of the Contract.

Submittal Descriptions (SD)

Submittals shall be identified with SD numbers and titles as follows:

SD 1 PRE-CONSTRUCTION SUBMITTALS

Certificates of insurance
Surety bonds
List of proposed subcontractors
List of proposed products
Construction Progress Schedule
Submittal register
Schedule of prices
Work plan
Quality control plan

SD 2 SHOP DRAWINGS

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD 3 PRODUCT DATA

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

SD 4 SAMPLES

Samples of warranty language when the contract requires extended product warranties.
Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies, which are to be incorporated into the project and those, which will be removed at conclusion of the work.

**SD 5  DESIGN DATA**

Calculations mix designs, analyses or other data pertaining to a part of work.

**SD 6  TEST REPORTS**

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report, which includes findings of a test, required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report, which includes finding of a test, made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily checklists.

Final acceptance test and operational test procedure.

**SD 7  CERTIFICATES**

Statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

**SD 8  MANUFACTURER'S INSTRUCTIONS**

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.
SD 9  MANUFACTURER'S FIELD REPORTS

Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

Factory test reports.

SD 10  OPERATION AND MAINTENANCE DATA

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. Operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item need this data.

SD 11  CLOSEOUT SUBMITTALS

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

1.1.1  REVIEWING AUTHORITY

Engineer reviewing the submittal.

1.1.2  WORK

As used in this section, on and offsite construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2  SUBMITTALS

Contractor shall use a standard transmittal form approved by the Engineer to transmit each submittal. Submittals shall be transmitted electronically by e-mail to the address provided by the Engineer. It shall be the Contractor's responsibility to confirm that the submittals are received. Unless otherwise noted, e-mail all submittals to the Engineer for review.

Prior to the pre-construction conference, the Contractor shall prepare a list and schedule of the proposed submittals and submit to the Engineer for review and approval. The list shall be comprehensive and shall include information for all materials and equipment as required to show conformance with the Drawings and Specifications.

Submittal Description (SD): Drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials to be furnished by the Contractor explaining in detail specific portions of the work required by the Contract.

The previously described Submittal Descriptions SD-01 through SD-11 lists the requirements for data to be submitted for the project. The specific requirements will be described in each specification section.
1.3 PROCEDURES FOR SUBMITTALS

1.3.1 REVIEWING, CERTIFYING, APPROVING AUTHORITY

The Engineer shall be responsible for reviewing and that submittals are in compliance with contract requirements. Approving authority on submittals is the Engineer, unless otherwise specified, for the specific submittal.

1.3.2 CONSTRAINTS

a. Submittals listed or specified in this contract shall conform to provisions of this section, unless explicitly stated otherwise.

b. Submittals shall be complete for each definable feature of work; components of definable feature interrelated as a system shall be submitted at same time.

c. When acceptability of a submittal is dependent on conditions, items, or materials included separate subsequent submittals; submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.3.3 SCHEDULING

Within 7 days of Notice to Proceed, the Contractor shall provide for approval by the Engineer the following schedule of submittals: A schedule of shop drawings and technical submittals required by the specifications and drawings. Schedule shall indicate the specification or drawing reference requiring the submittal; the material, item or process for which the submittal is required; identifying title of the submittal; the Contractor's anticipated submission date and the approval need date. In order to meet time lines, the Contractor shall:

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.

b. Except as specified otherwise, allow review period, beginning with receipt by reviewing authority, that includes at least 15 working days for submittals to the Engineer. Period of review for submittals begins when the Engineer receives the submittal. Period of review for each re-submittal is the same as for initial submittal.

1.3.4 VARIATIONS

Variations from contract requirements require review by the Engineer with a recommendation to the Owner for the final decision when the variations involve contract time or contract costs. Variations that affect neither contract time or contract costs will be reviewed by the Engineer in accordance with the Engineer's responsibilities as described in the General Conditions of the Contract.
1.3.4.1 CONSIDERING VARIATIONS

Discussion with the Engineer prior to submission will help ensure functional and quality requirements are met and minimize rejections and re-submittals.

1.3.4.2 PROPOSING VARIATIONS

When proposing variation, deliver written request to the Engineer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to the County. If lower cost is a benefit, also include an estimate of the cost saving. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.3.4.3 WARRANTING THAT VARIATIONS ARE COMPATIBLE

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.3.4.4 THE REVIEW SCHEDULE IS MODIFIED

In addition to normal submittal review period, the Engineer of submittals with variations will allow a period of ten working days for consideration.

1.3.5 CONTRACTOR’S RESPONSIBILITIES

a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.

b. Transmit submittals to the Engineer in accordance with schedule on approved Submittal Log, and to prevent delays in the work, delays to the Development Authority, or delays to separate Contractors.

c. Advise Engineer of variation, as required by paragraph entitled "Variations."

d. Correct and resubmit submittal as directed by approving authority. When resubmitting rejected transmittals or transmittals noted for resubmittal, the Contractor shall provide copy of that previously submitted transmittal including all reviewer comments for use by approving authority. Direct specific attention in writing or on resubmitted submittal, to revisions not requested by approving authority on previous submissions.

e. Complete work that must be accomplished as basis of a submittal in time to allow submittal to occur as scheduled.

f. Ensure no work has begun until submittals for that work have been returned as "No Exceptions Noted," "Exception as Noted," or "Exception As Noted, Resubmission Not Required" except to the extent that a portion of work must be accomplished as basis of submittal.
1.3.6 ENGINEER RESPONSIBILITIES

a. Note date on which submittal was received from the Contractor on each submittal.

b. Review each submittal and check and coordinate each submittal with requirements of work and contract documents.

c. Review submittals for conformance with project design concepts and compliance with contract documents.

d. Act on submittals, determining appropriate action based on review of submittal.

1.3.7 ACTIONS POSSIBLE

Submittals shall be returned to the Contractor with one of the following notations:

a. Submittals marked "Not Reviewed" shall indicate the submittal has been previously reviewed and approved, is not required, or is incomplete. A submittal marked "Not Reviewed" will be returned to the Contractor with an explanation of the reason it is not reviewed. The Contractor shall resubmit submittals returned for being incomplete, with appropriate action, coordination, and change.

b. Submittals marked "No Exception Noted" authorize the Contractor to proceed with work covered.

c. Submittals marked "Exception Noted" or "Exception as Noted, Resubmission Not Required" authorizes the Contractor to proceed with work, as noted provided Contractor takes no exception to the notations.

d. Submittals marked "Revise and Resubmit" or "Rejected" indicate submittal is incomplete or does not comply with the design concept or the requirements of the contract documents and shall be resubmitted with appropriate changes. No work shall proceed for this item until the re-submittal is reviewed.

1.4 FORMAT OF SUBMITTALS

1.4.1 TRANSMITTAL FORM

The Contractor shall complete the "Transmittal of Contractor's Submittal" form, provided at the end of this section, for all required submissions to the Engineer. One copy of each of the submittals shall be attached to the submittal form and shall be sent to the following e-mail address:

dmotes@nfps.net (Debbie Motes)

1.4.2 IDENTIFYING SUBMITTALS

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on the transmittal form. Mark each submittal with the following:

a. Contract number.
b. Transmittal date.

c. Submittal name of each component of submittal.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier Contractor associated with submittal.

e. When a resubmission, add alphabetic suffix on submittal description, for example, SD-10A, to indicate resubmission.

f. Indicate in the space provided on the submittal transmittal form, whether the item submitted is a variation from the contract or not.

1.4.3 FORMAT FOR SD 02 SHOP DRAWINGS

a. Shop drawings shall not be less than 8 1/2 by 11 inches or more than 30 by 42 inches, except for full-size patterns or templates. Drawings shall have dark lines on a white background.

b. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals." The number of the submittal (e.g., first submittal) should be placed in a uniform location adjacent to the title block. The contract number shall appear in the margin, immediately below the title block, on each drawing.

d. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Shop drawing dimensions shall be the same unit of measure as indicated on the contract drawings, with scale indicated. Identify materials and products for work shown.

1.4.4 FORMAT FOR SD 03 PRODUCT DATA AND SD 08 MANUFACTURER'S INSTRUCTION'S

a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product that is being submitted. Indicate specification section number and paragraph number to which it pertains.

c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project.

1.4.5 FORMAT FOR SD 04 SAMPLES

a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

   (1) Sample of Equipment or Device: Full size.
(2) Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

(3) Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

(4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

(5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 2 by 4 inches.

(7) Sample Panel: 4 by 4 feet.

(8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range.

c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples shall be in undamaged condition at time of use.

d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

When naming a particular manufacturer and style specifies color, texture or pattern, include one sample of that manufacturer and style, for comparison.

1.4.6 FORMAT OF SD 05 DESIGN DATA AND SD 07 CERTIFICATES

a. Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.4.7 FORMAT OF SD 06 TEST REPORTS AND SD 09 MANUFACTURER'S FIELD REPORTS

a. Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

b. Indicate by prominent notation, each report in the submittal and the paragraph number to which it pertains.

1.4.8 FORMAT OF SD 10 OPERATION AND MAINTENANCE (O&M) DATA

a. O&M Data format shall comply with the requirements specified in Section 01781, "Operation and Maintenance Data"

1.4.9 FORMAT OF SD 01 PRECONSTRUCTION SUBMITTALS AND SD 11 CLOSEOUT SUBMITTALS
a. When submittal includes a document, which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying the document.

1.5 QUANTITY OF SUBMITTALS

1.5.1 NUMBER OF COPIES OF SHOP DRAWINGS

a. Submit one electronic copy of submittals of shop drawings requiring review and approval by the Engineer. One print, marked with review notations by the Engineer, will be returned to the Contractor.

1.5.2 NUMBER OF COPIES OF PRODUCT DATA AND MANUFACTURER'S INSTRUCTIONS

a. Submit two complete sets of indexed and bound product data. One print, marked with review notations by the Engineer, will be returned to the Contractor.

1.5.3 SD 04 NUMBER OF SAMPLES

a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or approving authority will retain set of samples and one will be returned to Contractor.

b. Submit one sample panel. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.5.4 NUMBER OF COPIES SD 05 DESIGN DATA AND SD 07 CERTIFICATES

a. Submit in compliance with quantity requirements specified for shop drawings.

1.5.5 NUMBER OF COPIES SD 06 TEST REPORTS AND SD 09 MANUFACTURER'S FIELD REPORTS

a. Submit in compliance with quantity with quality requirements specified for shop drawings.

1.5.6 NUMBER OF COPIES OF SD 10 OPERATION AND MAINTENANCE DATA

a. Submit five copies of O&M Data to the Engineer for review and approval.

1.5.7 NUMBER OF COPIES OF SD 01 PRECONSTRUCTION SUBMITTALS AND SD 11 CLOSEOUT SUBMITTALS

a. Unless otherwise specified, submit administrative submittals compliance with quantity requirements specified for shop drawings.
1.6 FORWARDING SUBMITTALS

1.6.1 SUBMITTALS REQUIRED FROM THE CONTRACTOR

As soon as practicable after award of contract and before procurement of fabrication, forward to the Engineer submittals required in the technical sections of this specification, including shop drawings, product data and samples.

1.6.1.1 O&M DATA

The Engineer will review and approve O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the Contract site.

i. In the event the Contractor fails to deliver required O&M Data within the time limits specified, the Engineer may withhold 50 percent of the price of the O & M items affected from progress payments.

1.7 SUBMITTALS WITH NO EXCEPTIONS NOTED

The Engineer's notation of "No Exception Noted" of submittals shall not be construed as a complete check but will indicate only that the design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Review notations will not relieve the Contractor of the responsibility for any error, which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After a submittal has been notated "No Exception Noted" by the Engineer, no re-submittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.8 REJECTED SUBMITTALS

The Contractor shall make all corrections required by the Engineer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. Any "information only" submittal found to contain errors or unapproved deviations from the Solicitation or Accepted Proposal shall be resubmitted as one requiring "approval" action. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Engineer.

1.9 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.10 GENERAL

The Contractor shall make submittals as required by the specifications. The Engineer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract
requirements. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Engineer approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.11 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 15 calendar days exclusive of mailing time) shall be allowed and shown on the schedule of submittals for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

1.12 SUBMITTAL PROCEDURES

Submittals shall be made as follows:

1.12.1 PROCEDURES

The Engineer will further discuss detailed submittal procedures with the Contractor at the Preconstruction Conference.

1.12.2 DEVIATIONS

For submittals, which include proposed deviations requested by the Contractor, the column "variation" of the submittal transmittal form shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Development Authority reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.13 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittall Log."

1.14 INFORMATION ONLY SUBMITTALS

 Normally submittals for information only will not be returned. Approval of the Engineer is not required on information only submittals. The Engineer reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Engineer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Development Authority laboratory or for check testing by the Development Authority in those instances where the technical specifications so prescribe.
1.15 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR ________________________________

(Firm Name) ________________________________

_____ Approved

_____ Approved with corrections as noted on submittal data and/or attached sheets(s).

SIGNATURE: ______________________________________________________

TITLE: __________________________________________________________

DATE: ____________________________

PART 2 - PRODUCTS (This part does not apply)

PART 3 - EXECUTION (This part does not apply)

END OF SECTION
SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 SITE PLAN

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent tracking of mud shall be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 EMPLOYEE PARKING

Contractor employees and subcontractors shall park privately owned vehicles in an area designated by the Engineer and the Owner. This area will be within reasonable walking distance of the construction site. The Contractor's employees or subcontractors shall not park outside of the designated area. Contractor employee parking shall not interfere with existing and established parking requirements of the County.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 PAYMENT FOR ELECTRIC UTILITY SERVICES

The Contractor shall make arrangements and pay all costs for their own temporary power facilities that may be desired.

1.2.2 TOILET FACILITIES

The Contractor shall provide and maintain within the construction area at a minimum field-type toilet facilities for the Contractor's work force. The facilities shall have frequent cleanings (at least twice weekly) and shall be stocked with paper products on a daily or as needed basis. Coordinate placement of the toilet facilities with the Engineer and Owner.

1.3 BULLETIN BOARD AND PROJECT SIGN

The requirements for the signs, their content, and location shall be as shown on the drawings or as specified. The signs shall be erected within 15 days after receipt of the notice to proceed. Upon completion of the project, the signs shall be removed from the site.

1.3.1 BULLETIN BOARD

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information with prior notification to the Engineer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees with prior notification to the Engineer.
Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.3.2 PROJECT SIGN

Provide a professionally painted project sign with project information to be provided by the OWNER. The sign shall be painted on a pressure treated, 0.75" x 48" x 96" plywood base and shall be mounted at the Suwannee County Wastewater plant site in Suwannee County, Florida on two 4" x 4" x 96" pressure treated posts with galvanized fasteners. The sign shall be erected in the location as directed by the OWNER, and shall be removed at the close of the project.

1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Engineer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.4.1 HAUL ROADS

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Engineer shall be removed.

1.4.2 BARRICADES

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.
1.5 CONTRACTORS TEMPORARY FACILITIES

1.5.1 ADMINISTRATIVE FIELD OFFICES

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. The Owner's office, maintenance, and warehouse facilities will not be available to the Contractor's personnel.

1.5.2 APPEARANCE OF TRAILERS

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers, which, in the opinion of the Engineer or Owner, require exterior painting or maintenance, will not be allowed on the property.

1.5.3 MAINTENANCE OF STORAGE AREA

Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction areas shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.5.4 SECURITY PROVISIONS

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

The Contractor shall also maintain and make available to the Engineer an Email account that will allow the Engineer to communicate with the Contractor's Project Manager and Project Superintendent on the project site. The Email account shall allow attachments up to 15 MB to be passed through the server to the Contractor's PC and/or cell phone. The Contractor shall have PC-based capability to work with Microsoft Office Professional files, Microsoft Project, and be able to read Adobe Acrobat files.

1.6 ENGINEER FIELD OFFICE

The Contractor shall make available to the Engineer's personnel when in the field, air-conditioned space in the Contractor's field office, to provide a place where the Engineer's personnel can make phone calls, review documents, and write field reports.

1.7 SITE SECURITY

The Contractor shall provide lockable storage and fenced areas as required to secure stored materials for the project.
1.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing within the work areas. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

1.9 SITE HOUSEKEEPING AND CLEANUP

The Contractor shall provide diligent site housekeeping services during the course of the project. Construction debris, waste materials, packaging material and the like shall be picked up from the work site daily and disposed of in suitable receptacles. The contractor shall also provide and maintain at two smaller outdoor waste receptacles around the site for disposal of garbage. The Contractor maintain at the site roll-off or dumpster type receptacles for both construction debris and garbage. Construction debris receptacle shall be emptied when full and the garbage receptacle shall be emptied weekly.

Dirt or mud, which is tracked onto paved or surfaced roadways, shall be cleaned away. Materials resulting from demolition activities, which are salvageable, shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or aged, shall be neatly stacked when stored.

1.10 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to original condition, including topsoil and seeding as necessary.

END OF SECTION
SECTION 01780
CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

**SD-02 SHOP DRAWINGS**

AS-BUILT DRAWINGS

The Contractor shall maintain a copy of working redlined Drawings at the site during construction showing all changes from the original design. The drawings shall be updated on a weekly basis, and review of those documents by the Engineer shall be a part of the monthly progress payment review.

**SD-03 PRODUCT DATA**

AS-BUILT RECORD OF EQUIPMENT AND MATERIALS

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

WARRANTY MANAGEMENT PLAN

One set of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

WARRANTY TAGS

Two record copies of the warranty tags showing the layout and design.

FINAL CLEANING

Two copies of the listing of completed final clean-up items.

1.2 PROJECT RECORD DOCUMENTS

The Contractor shall maintain record copies of documents as required by the Standard General Conditions of the Construction Contract.

1.2.1 AS-BUILT DRAWINGS

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and
"final as-built "drawings" refer to contract drawings which are revised to be used for final as-built drawings.

1.2.1.1 WORKING AS-BUILT AND FINAL AS-BUILT DRAWINGS

The Contractor shall maintain a set of paper drawings by redline process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a weekly basis and at least one set shall be available on the jobsite at all times. Changes from the contract plans, which are made in the work, or additional information, which might be uncovered in the course of construction, shall be accurately and neatly recorded as they occur by means of details and notes. The Engineer and the Contractor prior to submission of each monthly pay estimate will jointly review the working as-built marked prints for accuracy and completeness. If the Contractor fails to maintain the working as-built drawings as specified herein, the Engineer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Engineer and the Contractor regarding the accuracy and completeness of updated drawings.

Prior to application for final payment the Contractor shall review the redlined drawings with the Engineer and prepare an AutoCAD 2018 .dwg file of the final CAD drawings with all changes shown in a clear legible manner.

As-built CAD drawings shall be prepared and sealed by a licensed Florida Professional Land Surveyor.

The working and final as-built drawings shall show, but shall not be limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
f. Changes or modifications, which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on OWNER property, or if OWNER property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures.

   1) Directions in the modification for posting descriptive changes shall be followed.

   2) A Modification Circle shall be placed at the location of each deletion.

   3) For new details or sections, which are added to a drawing, a Modification Circle shall be placed by the detail or section title.

   4) For minor changes, a Modification Circle shall be placed by the area changed on the drawing (each location).

   5) For major changes to a drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.

   6) For changes to schedules or drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.

   7) The Modification Circle size shall be 1/2-inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.2.1.2 DRAWING PREPARATION

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints and adding such additional drawings as may be necessary. These working as-built marked prints shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be reviewed by the Engineer. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the OWNER.
1.2.1.3 COMPUTER AIDED DESIGN AND DRAFTING (CADD) DRAWINGS

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the Contract drawings or to prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files.

a. CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

b. Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.

c. Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.

d. Special (Blue) - Items requiring special information, coordination, or special detailing, etc. detailing notes shall be in blue.

e. Drawings with marked-up changes shall be renamed and saved separately from the original drawings. All changes shall be made on the layer/level as the original item. There shall be no deletions of existing lines; existing lines shall be over struck in red. Additions shall be in green with line weights the same as the drawing. Special notes shall be in blue on layer #63.

f. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 3/16 inch high. All other contract drawings shall be marked either "As-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

g. All as-built drawings shall be prepared by and signed and sealed by a licensed Florida Professional Land Surveyor.

1.2.1.4 PAYMENT

No separate payment will be made for as-built drawings required under this contract.
1.3 WARRANTY MANAGEMENT

1.3.1 WARRANTY MANAGEMENT PLAN

The Contractor shall develop a warranty management plan. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Engineer review. The warranty management plan shall include all required actions and documents to assure that the OWNER receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Engineer for review prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Engineer upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. Information contained in the warranty management plan shall include, but shall not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include balancing, pumps, motors, transformers, and for all commissioned systems.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.
2. Model and serial numbers.
3. Location where installed.
4. Name and phone numbers of manufacturers or suppliers.
5. Names, addresses and telephone numbers of sources of spare parts.
6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items, which have extended warranties, shall be indicated with separate warranty expiration dates.
7. Cross-reference to warranty certificates as applicable.
8. Starting point and duration of warranty period.
9. Summary of maintenance procedures required to continue the warranty in force.
11. Organization, names and phone numbers of persons to call for warranty service.
12. Typical response time and repair time expected for various warranted equipment.

d. Procedure and status of tagging of all equipment covered by extended warranties.

e. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
1.3.2 WARRANTY TAGS

At the time of installation, each warranted item shall be tagged with a durable, oil and water-resistant tag approved by the Engineer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The tag shall show the following information.

a. Type of product/material ________________________________.

b. Model number ________________________________.

c. Serial number ________________________________.

d. Contract number ________________________________.

e. Warranty period ________ from __________ to ________.

f. Inspector’s signature ________________________________.

g. Construction Contractor ________________________________.

h. Address ________________________________.

i. Telephone number ________________________________.

j. Warranty contact ________________________________.

k. Address ________________________________.

l. Telephone number ________________________________.

m. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.4 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and reviewed by the Engineer.

1.5 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted by the Contractor. Those provided in a common volume shall be clearly differentiated and shall be separately indexed.
1.6 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be cleaned. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

END OF SECTION
SECTION 01781

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit five printed copies and one electronic pdf copy of Operation and Maintenance (O&M) Data specifically applicable to this Contract and a complete and concise depiction of the provided equipment, product or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01330, "Submittal Procedures."

1.1.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.1.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission.

1.1.3 Changes to Submittals

The Contractor shall furnish manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. The Contractor shall submit changes, additions or revisions required by the Engineer for final acceptance of submitted data, within 30 calendar days of the notification of this change requirement.

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 OPERATING INSTRUCTIONS

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.2.1.1 SAFETY PRECAUTIONS

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.2.1.2 OPERATOR PRE-START

Include procedures required to set up and prepare each system for use.
1.2.1.3 STARTUP, SHUTDOWN AND POST-SHUTDOWN PROCEDURES

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.2.1.4 NORMAL OPERATIONS

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.2.1.5 EMERGENCY OPERATIONS

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment.
Include Emergency Shutdown Instructions for fire, explosion, spills or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.2.1.6 OPERATOR SERVICE REQUIREMENTS

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

1.2.1.7 ENVIRONMENTAL CONDITIONS

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.2.2 PREVENTIVE MAINTENANCE

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.2.2.1 LUBRICATION DATA

Include preventative maintenance lubrication data, in addition to instructions for lubrications provided under paragraph titled "Operator Service Requirements":

   a. A table showing recommended lubricants for specific temperature ranges and applications.

   b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

   c. A Lubrication Schedule showing service interval frequency.
1.2.2 PREVENTIVE MAINTENANCE PLAN AND SCHEDULE

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.2.3 CORRECTIVE MAINTENANCE (REPAIR)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

1.2.3.1 TROUBLESHOOTING GUIDES AND DIAGNOSTIC TECHNIQUES

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or requires replacement.

1.2.3.2 WIRING DIAGRAMS AND CONTROL DIAGRAMS

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.2.3.3 MAINTENANCE AND REPAIR PROCEDURES

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.2.3.4 REMOVAL AND REPLACEMENT INSTRUCTIONS

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly and assembly of components, assemblies, subassemblies, accessories and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 SPARE PARTS AND SUPPLY LISTS

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.
1.2.4 CORRECTIVE MAINTENANCE WORK-HOURS

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.5 APPENDICES

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.6 PARTS IDENTIFICATION

Provide identification and coverage for all parts of each component, assembly, subassembly and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference or key number that will cross-reference the illustrated part to the listed part. Components, assemblies and subassemblies in accordance with the manufacturer’s standard practice shall group parts shown in the listings. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments or accessories, such as typically shown in a master parts catalog.

1.2.6.1 WARRANTY INFORMATION

Provide a master list of all equipment and devices along with a summary of the individual warranty information, local service contacts, and factory service contacts. List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the process equipment such as aerators, pumps, valves, motors, electrical equipment, air conditioning system compressor, etc.

1.2.6.2 PERSONNEL TRAINING REQUIREMENTS

Provide information available from the manufacturers that are needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.2.6.3 TESTING EQUIPMENT AND SPECIAL TOOL INFORMATION

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance and repair of components.

1.2.6.4 CONTRACTOR INFORMATION

Provide a list that includes the name, address and telephone number of the General Contractor and each Subcontractor who installed the product, equipment or system. For each item, also provide the name address and telephone number of the
manufacturer's representative and service organization most convenient to the project site. Provide the name, address and telephone number of the product, equipment and system manufacturers.

1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O & M data packages specified below unless specified otherwise in the individual technical sections of the specifications. The information shall be bound in locking type, three ring binders, indexed and tabbed to facilitate use of the information by the OWNER. The binders shall be limited to 3” per volume. Provide as many volumes as needed to provide the required materials. For each set of O & M Manuals, provide duplicate information on CD in Adobe Acrobat “.pdf” format to allow the OWNER to easily make field copies of needed information.

<table>
<thead>
<tr>
<th>Item</th>
<th>O &amp; M Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe and Accessories</td>
<td>Data Package 1</td>
</tr>
<tr>
<td>Valves</td>
<td>Data Package 2</td>
</tr>
<tr>
<td>Main Lift Station</td>
<td>Data Package 4</td>
</tr>
<tr>
<td>Water Meters and Flow Meters</td>
<td>Data Package 2</td>
</tr>
<tr>
<td>Electrical Conduit, Panels, Breakers, Wiring, Lighting, Heaters, Fans and Associated Devices</td>
<td>Data Package 4</td>
</tr>
<tr>
<td>Fencing &amp; Gates</td>
<td>Data Package 1</td>
</tr>
<tr>
<td>WWTP</td>
<td>Data Package 4</td>
</tr>
<tr>
<td>Drying Bed</td>
<td>Data Package 5</td>
</tr>
<tr>
<td>Under Drain Pump Station</td>
<td>Data Package 5</td>
</tr>
<tr>
<td>Buildings</td>
<td>Data Package 2</td>
</tr>
<tr>
<td>Standby Generators</td>
<td>Data Package 4</td>
</tr>
<tr>
<td>Propane tanks</td>
<td>Data Package 5</td>
</tr>
<tr>
<td>Yard Lighting</td>
<td>Data Package 1</td>
</tr>
</tbody>
</table>

The required information for each O&M data package is as follows:

1.3.1 DATA PACKAGE 1

   a. Safety precautions
   
   b. Maintenance and repair procedures
   
   c. Warranty information
   
   d. Contractor information
   
   f. Spare parts and supply list

1.3.2 DATA PACKAGE 2

   a. Safety Precautions
   
   b. Normal operations
1.3.3 DATA PACKAGE 3

a. Safety precautions
b. Normal operations
c. Emergency operations
d. Environmental conditions
e. Lubrication data
f. Preventive maintenance plan and schedule
g. Troubleshooting guides and diagnostic techniques
h. Wiring diagrams and control diagrams
i. Maintenance and repair procedures
j. Removal and replacement instructions
k. Spare parts and supply list
l. Parts identification
m. Warranty information
n. Testing equipment and special tool information
o. Contractor information

1.3.4 DATA PACKAGE 4

a. Safety precautions
b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Corrective maintenance man-hours

p. Parts identification

q. Warranty information

r. Personnel training requirements

s. Testing equipment and special tool information

t. Contractor information

1.3.5 Data Package 5

a. Safety precautions

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques
h. Wiring and control diagrams
i. Maintenance and repair procedures
j. Spare parts and supply list
k. Testing equipments and special tools
l. Warranty information
m. Contractor information

PART 2 - PRODUCTS (This part does not apply)

PART 3 - EXECUTION (This part does not apply)

END OF SECTION
SECTION 01810
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 - GENERAL

1.1 DEFINITIONS

A. Facilities: Entire Project, or an agreed-upon portion, including all of its unit processes.

B. Functional Test: Test or tests in presence of ENGINEER and OWNER to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.

C. Performance Test: Test or tests performed after any required functional test in presence of ENGINEER and OWNER to demonstrate and confirm individual equipment meets performance requirements specified in individual Sections.

D. Unit Process: As used in this Section, a unit process is a portion of the facility that performs a specific process function, such as a sewage pump (lift) station.

E. Facility Performance Demonstration:

1. A demonstration, conducted by CONTRACTOR, with assistance of OWNER, to demonstrate and document the performance of the entire operating facility, both manually and automatically (if required), based on criteria developed in conjunction with OWNER and as accepted by ENGINEER.

2. Such demonstration is for the purposes of (1) verifying to OWNER entire facility performs as a whole, and (2) documenting performance characteristics of completed facility for OWNER's records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or entire facility the responsibility of CONTRACTOR, unless such performance is otherwise specified.

1.2 SUBMITTALS

A. Informational Submittals:

1. Facility Startup and Performance Demonstration Plan.

2. Functional and performance test results.

3. Completed Unit Process Startup Form for each unit process.


1.3 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

A. Develop a written plan, in conjunction with OWNER’s operations personnel to include the following:

1. Step-by-step instructions for startup of each unit process and the complete facility.
2. Unit Process Startup Form (sample attached), to minimally include the following:
   a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.
   b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
   c. Startup requirements for each unit process, including water, power, chemicals, etc.
   d. Space for evaluation comments.

3. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
   a. Description of unit processes included in the facility startup.
   b. Sequence of unit process startup to achieve facility startup.
   c. Description of computerized operations, if any, included in the facility.
   d. CONTRACTOR certification facility is capable of performing its intended function(s), including fully automatic operation.
   e. Signature spaces for CONTRACTOR and ENGINEER.

PART 2 - PRODUCTS (This part does not apply)

PART 3 - EXECUTION

3.1 GENERAL

A. Facility Startup: Schedule all startup activities at the monthly status meetings per paragraph 1.8 Section 01000 and also discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and OWNER involvement.

B. Contractor's Testing and Startup Representative:
   1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup.
   2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.

C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

D. Provide Subcontractor and equipment manufacturers' staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

E. CONTRACTOR will provide potable water as required for startup.
3.2 EQUIPMENT TESTING

A. Preparation:

1. Complete installation before testing.

2. Furnish qualified manufacturers’ representatives, when required by individual; Specification sections.

3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form, in accordance with Section 01640, MANUFACTURERS' SERVICES, when required by individual Specification sections.

4. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
   a. OWNER/Project Name.
   b. Equipment or item tested.
   c. Date and time of test.
   d. Type of test performed (Functional or Performance).
   e. Test method.
   f. Test conditions.
   g. Test results.
   h. Signature spaces for CONTRACTOR and ENGINEER as witness.

5. Cleaning and Checking: Prior to beginning functional testing:
   a. Calibrate testing equipment in accordance with manufacturer's instructions.
   b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
   c. Lubricate equipment in accordance with manufacturer's instructions.
   d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.
   e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
   f. Check power supply to electric-powered equipment for correct voltage.
   g. Adjust clearances and torque.
   h. Test piping for leaks.

6. Ready-to-test determination will be by ENGINEER based at least on the following:
   a. Acceptable Operation and Maintenance Data.
   b. Notification by CONTRACTOR of equipment readiness for testing.
   c. Receipt of Manufacturer’s Certificate of Proper Installation, if so specified.
   d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
   e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
   f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
   g. Equipment and electrical tagging complete.
   h. Delivery of all spare parts and special tools.
B. Functional Testing:

1. Conduct as specified in individual Specification sections.

2. Notify OWNER and ENGINEER in writing at least 10 days prior to scheduled date of testing.


4. When, in ENGINEER's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual Specification sections. Such acceptance will be evidenced by ENGINEER/OWNER's signature as witness on Equipment Test Report.

C. Performance Testing:

1. Conduct as specified in individual Specification sections.

2. Notify ENGINEER and OWNER in writing at least 10 days prior to scheduled date of test.

3. Performance testing shall not commence until ENGINEER has accepted equipment as having satisfied functional test requirements specified.

4. Type of fluid, gas, or solid for testing shall be as specified.

5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.


7. When, in ENGINEER's opinion, equipment meets performance requirements specified, such equipment will be accepted as to conforming to Contract requirements. Such acceptance will be evidenced by ENGINEER's signature on Equipment Test Report.

3.3 STARTUP OF UNIT PROCESSES

A. Prior to unit process startup, equipment within unit process shall be accepted by ENGINEER as having met functional and performance testing requirements specified.

B. Startup sequencing of unit processes shall be as chosen by CONTRACTOR to meet schedule requirements.

C. Make adjustments, repairs, and corrections necessary to complete unit process startup.

D. Startup shall be considered complete when, in opinion of ENGINEER, unit process has operated in manner intended for 5 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.
E. Significant Interruption: May include any of the following events:

1. Failure of CONTRACTOR to provide and maintain qualified onsite startup personnel as scheduled.

2. Failure to meet specified functional operation for more than 2 consecutive hours.

3. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.

4. Failure of any non-critical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.

5. As determined by ENGINEER.

F. A significant interruption will require startup then in progress to be stopped. After corrections are made, startup test period to start from beginning again.

3.4 FACILITY PERFORMANCE DEMONSTRATION

A. When, in the opinion of ENGINEER, startup of all unit processes has been achieved, sequence each unit process to the point that facility is operational.

B. Demonstrate proper operation of required interfaces within and between individual unit processes.

C. After facility is operating, complete performance testing of equipment and systems not previously tested.

D. Document, as defined in Facility Startup and Performance Demonstration Plan, the performance of the facility, until all unit processes are operable and under control of computer system.

E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic and computerized operation.

END OF SECTION
UNIT PROCESS STARTUP FORM

OWNER: ___________________________ PROJECT: _____________________________

Unit Process Description: (Include description and equipment number of all equipment and devices):

_____________________________________________________________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________

Startup Procedure (Describe procedure for sequential startup and evaluation, be opened/closed, order of equipment startup, etc.):

_____________________________________________________________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________

Startup Requirements (Water, power, chemicals, etc.): ________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________

Evaluation Comments:

_____________________________________________________________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________

_____________________________________________________________________________________
FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER: ______________________________       PROJECT: _________________________________

Unit Processes Description (List unit processes involved in facility startup):
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Unit Processes Startup Sequence (Describe sequence for startup, including computerized operations, if any):
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

CONTRACTOR Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: ____________________________       Date: ____________________________, 20____

Engineer: ______________________________       Date: ____________________________, 20____
SECTION 02140

DEWATERING

PART 1 - GENERAL

1.1 SCOPE

In general, the work specified in this section of the Specifications shall consist of supplying labor, materials and equipment, and performing all work necessary to lower and control the groundwater levels and hydrostatic pressures to permit all excavations and construction specified under this Contract to be performed in the dry.

1.2 EXAMINATION OF THE SITE

The Contractor shall take all steps necessary to familiarize him with the site conditions, the ground conditions and the groundwater conditions. It is expressly understood that neither the Owner's nor Owner's Representative will be held responsible for any interpretations or conclusions drawn by the Contractor.

PART 2 - PRODUCT

2.1 METHOD AND EQUIPMENT

The Contractor may use any dewatering method he deems feasible so long as it results in working in the dry and stable soils conditions. It is the intent of these Specifications that an adequate dewatering system be installed to lower and control the groundwater in order to permit excavation, construction of the structures and the placement of the fill materials, all to be performed under dry conditions. The dewatering system shall be adequate to pre-drain the water bearing strata above and below the bottom of the foundations, sewers, water lines and all other excavations. An adequate weight of fill material shall be in place prior to discontinuing operation of dewatering to prevent buoyancy of any structure. All dewatering operations shall be in accordance with applicable requirements of authorities having jurisdiction, such as, but not limited to, Suwannee River Water Management District and Florida Department of Environmental Protection.

PART 3 - EXECUTION

3.1 GENERAL

The Contractor shall be solely responsible for arrangement, location and depths of the dewatering system necessary to accomplish the work described under this section of the Specifications. The dewatering shall be accomplished in a manner that will reduce the hydrostatic head below any excavation to the extent that the water level and piezometer water levels in the construction area are below the prevailing excavation surface; will prevent the loss of fines, seepage, boils, quick conditions, or softening of the foundation strata; will maintain stability of the sides and bottom of the excavation; and will result in all construction operations being performed in the dry.

3.2 DISPOSAL OF WATER

The Contractor shall promptly dispose of all water removed from the excavations in such a manner as will not endanger public health, damage public or private property, or affect
adversely any portion of the work under construction or completed by him or any other Contractor. Contractor shall obtain written permission from the Owner of any property involved before digging ditches or constructing watercourses for the removal of water. Contractor shall apply for and obtain at the Contractor's expense from all agencies having jurisdiction all permits required for disposal of water resulting from dewatering operations.

Where excavation and dewatering occurs in soils containing clay, silt or other materials resulting in turbidity in excess of 29 NTU above background at the point of discharge, the Contractor shall provide for settling, filtering or other treatment to lower turbidity to this level. If the project contains stormwater retention and/or detention systems, the Contractor may temporarily use this area for treatment, by capping the bleed-down pipe, pumping discharge in the pond and allowing it to settle prior to discharge. He may also construct a temporary detention/treatment pond. Use of alum and polymeric coagulation agents to aid in settling is allowed, providing that pH is adjusted prior to discharge. The Contractor shall submit his dewatering plan to the Engineer for approval if such additives are used, and submit pH test data to the Engineer showing no greater than 1 pH unit change from background in water to be discharged.

3.3 INADEQUATE SYSTEM

If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation strata, or instability of the slopes, or damage to the foundations or structures may occur. The supply of all labor, materials and equipment, and the performance of all work necessary to carry out additional work for reinstatement of the structures or foundation soil resulting from such inadequacy or failure shall be undertaken by the Contractor to the approval of the Owner's Representative, and at no additional expense to the Owner.

END OF SECTION
SECTION 02222

EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

This section includes excavation, bedding, and backfilling for utilities necessary to perform all work necessary to prepare for laying the piping or main, including clearing, digging the trench, preparing the pipe bed, compacting, and preparing the surface restoration, and disposal of surplus material.

Maintain in operating condition existing utilities, active utilities, and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.

Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Drawings. Comply with permits and regulations according to General Conditions.

1.2 SUBMITTALS:

Shop Drawings or details pertaining to excavation and backfill are not required unless use of materials, methods, equipment, or procedures contrary to Drawings or these specifications are proposed. Do not perform work until Owner and Engineer have accepted required shop drawings.

1.3 JOB CONDITIONS

Set all lines, elevations, and grades for utility system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.

1.4 TRENCH SAFETY

Care shall be taken to strictly observe all applicable, State, local and Federal standards with respect to the safety of persons during excavation and backfill. The contractor shall recognize OSHA excavation safety standards, agree to abide by them, and identify the costs to comply. The bidder, therefore, acknowledges that the total bid price includes costs for complying the Florida Trench Safety Act (90-96, Laws of Florida), effective October 1, 1990.

1.5 JACK AND BORE, DIRECT BORE CONSTRUCTION (IF APPLICABLE):

Jack and bore direct bore and directional drilling construction shall be conducted in accordance with the Florida Department of Transportation Utilities Accommodation Guide and applicable permits issued.

1.6 TESTING

Testing shall be conducted in accordance with AASHTO T-180, modified proctor density test. Tests shall be conducted on all trench backfill within 10 feet of pavement or proposed pavement areas and under all existing paved areas.
Frequency tests shall be conducted at each public roadway crossing and at no less than 300-foot intervals along the pipeline or on each pipeline run between manholes, inlets (junction boxes in accordance with these specifications. There shall be at least one test per layer placed.

Test report results shall be furnished to the Owner and Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material:
   Processed sand and gravel free from clay lumps, organic, or other deleterious material, and complying with following gradation requirements: U.S. Sieve Size Passing by Weight, 1 Inch 100 percent, 3/4 Inch 90-100 percent, 3/8 Inch 20-55 percent, No.4 0 10 percent, and No.8 0 5 percent.

PART 3 - EXECUTION

3.1 EXCAVATION, TRENCHING, AND BACKFILLING

Performing excavation as indicated or specified depths. During excavation, pile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

Remove excavated materials not required or not suitable for backfill or embankments and waste as specified.

Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

3.2 TRENCH EXCAVATION

Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks as nearly vertical as practical and remove stones as necessary to avoid point bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. The amount of trench to be open at anyone time shall be limited at the discretion of the Engineer to minimize public inconvenience and/or damage to life or property. Not more than 1,000’ feet of trench shall be opened ahead of pipe laying operations, unless the Engineer approves greater length of trench.

All existing utilities such as pipes, poles and structures shall be carefully supported and protected from injury, and in case of damage, they shall be restored at no cost to the Owner. Any pipes, conduits, wires, mains footings, or other underground structures encountered in trenching operations shall be carefully protected from injury or displacement. The Contractor to the satisfaction of the Engineer and the Owner thereof thereto shall fully, promptly and properly repair any damage.
Failure of the plans to show the exact location, nature or extent of any sub-surface obstruction shall not be the basis of a claim for extra work.

All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheeted, braced or otherwise supported by means of the sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to and exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on undisturbed soil or bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

The minimum width of the trench shall be equal to the outside diameter of the pipe at the bell plus six (6) inches on each side of the pipe. All other trench width requirements for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

3.3 SHEETING AND BRACING

Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen required. Sheetling may be removed after excavation has been backfilled sufficiently to protect against damaging or injurious caving.

3.4 PIPE BEDDING

Accurately cut trenches for pipe or conduit that is installed to designated elevations and grades to line and grade 4" below bottom of pipe and to width as specified. Place 4" of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place select backfill and compact in maximum 6" layers, measured loose, to at least 12" above top of pipe.

3.5 TRENCH BACKFILLING

A. Criteria
Do not backfill trenches until required tests are performed, utility systems, as installed, comply with specified requirements, and are accepted by applicable governing authority. Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified, to properly correct condition in an acceptable manner.

B. Backfilling
After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in lifts or layers not exceeding 8" of loose material. Compact to minimum density of 98% of optimum density in accordance with ASTM D 698 or AASHTO T-99.
C. Compaction
   Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Compaction Testing
   Independent testing laboratory shall perform test at intervals not exceeding 300 feet of trench for each 12" of compacted trench backfill and furnish copies of test results as specified.

3.6 RESTORATION OF SURFACE

   The top surface of the trench fill shall be restored to the original or planned condition. Paved sections shall conform in grade to the adjacent area. Restoration shall be completed as promptly as practicable and shall not be prolonged until the end of the construction period.

3.7 DEWATERING

   If dewatering activity is required, unless specifically authorized by the Engineer, all pipe shall be laid "in the dry". The Contractor shall minimize the length of excavation in advance of pipe laying so as to minimize the amount of trench dewatering required. The Contractor shall dewater before trench excavation, utilizing one or more of the following approved methods: well point system, trench gravity underdrain system, or sumps with pumps.

   Well point systems must be efficient enough to lower the water level in advance of the excavation and maintain it continuously in order that the trench bottom and sides shall remain firm and reasonably dry. The well points shall be designed especially for this type of service, and the pumping unit used shall be capable of maintaining of high vacuum, and at the same time, of handling large volumes of air as well as water.

   If the material encountered at trench grade is suitable for the passage of water without destroying the sides or bottom of the main trench, sumps may be provided at intervals to the side of the main excavation, and pumps may be used to lower the water level by taking their suction from these sumps. In the event such pumps are employed, care shall be exercised to prevent the movement of pipe foundation material and to this end a bed of crushed stone may be required.

   The Contractor shall be responsible for disposing of all water resulting from trench dewatering operations, and shall dispose of the water without damage or undue inconvenience to the work, the surrounding area, or the general public. He shall not dam, divert, or cause water to flow in excess in existing gutters, pavements, or other structures.

END OF SECTION
SECTION 02300

EARTHWORK

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subsurface drainage backfill for walls.
5. Excavating and backfilling for buried utility structures.

2.3 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Engineer. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.

1. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

2.4 SUBMITTALS

A. Product Data: For the following:


B. Samples: For the following:

1. 12-by-12-inch sample of drainage fabric.
2. 12-by-12-inch sample of separation fabric.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

2.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
2.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer's written permission.

3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 3 - PRODUCTS

3.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 98 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

3.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 110 lbf; ASTM D 4632.
2. Tear Strength: 40 lbf; ASTM D 4533.
5. Apparent Opening Size: No. 50; ASTM D 4751.

C. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 200 lbf; ASTM D 4632.
2. Tear Strength: 75 lbf; ASTM D 4533.
5. Apparent Opening Size: No. 30; ASTM D 4751.
PART 4 - EXECUTION

4.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

4.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

   2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

4.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Adjusting the Contract Sum according to unit prices included in the Contract Documents will pay for rock excavation.

   1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

      a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

   2. Rock excavation includes removal and disposal of rock.

      a. Do not excavate rock until it has been classified and cross-sectioned by Engineer.
4.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

4.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

4.6 APPROVAL OF SUBGRADE

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

4.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

4.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
4.9 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for record documents.

3. Inspecting and testing underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

4.10 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.

3. Under footings and foundations, use engineered fill.

4.11 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

4.12 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

D. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.

3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

4.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.

2. Walks: Plus or minus 1 inch.

3. Pavements: Plus or minus 1/2 inch.

4.14 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course on prepared subgrade and as follows:

1. Place base course material over subbase.

2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.

3. Shape subbase and base to required crown elevations and cross-slope grades.

4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
5. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.

4.15 DRAINAGE COURSE

A. Under slabs-on-grade, install drainage fabric on prepared subgrade according to manufacturer’s written instructions, overlapping sides and ends. Place drainage course on drainage fabric and as follows:

B. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

1. Compact drainage course to required cross sections and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.

3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

4.16 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.

B. Have testing agency inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.
4.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

   1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

4.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

   1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION
SECTION 02450

GENERAL RESTORATION

PART 1 - GENERAL

1.1 WORK INCLUDED

The work to be performed by the contractor under this section includes the furnishing of all labor, material and equipment necessary to restore the site to its original condition. All man-made and natural features in the construction site disturbed or removed for the proper completion of the work shall be reset or replaced. All man-made or natural features damaged or destroyed shall be repaired or restored to a condition equal to or better than that existing at the start of the work, with materials equal to or better than the original ones.

1.2 WORK NOT INCLUDED

Restoration of utility lines of private companies or municipalities is not included as part of this item. Items within dedicated rights-of-way which have been placed or constructed illegally by private entities or individuals are not included as part of this item.

1.3 SCOPE

After the work in an area has been completed, tested, and accepted, or when ordered by the ENGINEER, the restoration of all the man-made and natural features disturbed shall proceed. These features are of the general types outlined below but not necessarily limited to these specific items, as this specification item covers all required restoration work within these general categories.

A. Trees, shrubbery and bushes

B. Ground covers, lawns

C. Walls

D. Fences - This shall include such new work as footings, guys or braces as may be required to secure the work.

F. Sidewalks, Pathways, patios - all concrete pavements shall be repaired by replacing the section between the nearest two joints.

1.4 EQUIVALENT ITEMS

All features damaged or destroyed shall be repaired or restored with features equal to or better than the original ones. The Contractor shall make all reasonable attempts to satisfy the owner but the ENGINEER shall be the judge as to the reasonableness of equivalency of repaired and restored features.

In cases where it is impossible to replace an item with an equivalent item (large trees, exotic plants), the Contractor may substitute other similar items whose total value shall equal that of the destroyed one. This shall be completed to the satisfaction of the OWNER. In such cases,
the Contractor shall secure a written release from the owner stating that he is accepting a substitute for the destroyed item and that he releases the Contractor from further claim for said item.

PART 2 - PRODUCTS

Products to be provided under this section include but are not limited to those listed under Part 1, Section 1.3.

PART 3 - EXECUTION

3.1 CLEAN-UP

During the course of the Work, the Contractor shall keep the site of his operation in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction Work, and at the conclusion of the Work, he shall remove and haul away any surplus, excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operation, and shall leave the entire site of the Work in a neat and orderly condition.

3.2 MAINTENANCE AND PROTECTION OF WORK

All work done as part of this item shall be warranted for a period of one (1) year after the completion of the project as required by this contract and included in the surety for the project. Trenches that have settled shall be refilled to the proper grade. If this refilling operation disturbs the previous restoration of lawns, etc. the lawns, etc. shall again be restored to their original conditions under this item and at no additional costs to the OWNER.

Items replaced, replanted or restored shall be protected to insure their proper establishment. This protection may take any form required such as guying, wrapping, covering, barricades, shoring, etc.

3.3 MEASUREMENT AND COMPENSATION:

No measurement for payment under the restoration item shall be made as this item includes all work or materials that may be required to restore the site.

Payment for restoration shall be included in the bid price for all restoration work as generally outlined above, whether called for on the plans or not, as required to restore the site to its original condition. The price bid shall include the cost of furnishing all labor, material, and equipment necessary to complete the work as specified herein, and to maintain it.

END OF SECTION
SECTION 02570

SEWAGE FORCE MAINS

PART 1 - GENERAL

1.1 SCOPE

The work in this section shall include the furnishing and installing of all force mains, valves and vents, fittings and appurtenances required for a complete system as shown on the drawings and specified herein. It shall also include such connections, re-connections, temporary service and all other provisions in regard to the existing operation and modification as is required to perform the new work.

1.2 GENERAL REQUIREMENTS

A. All work shall be constructed properly in accordance with the Drawings and Specifications. All defects and leaks disclosed by the tests shall be repaired. The Contractor under supervision of the Engineer shall perform all tests. Water for testing will be furnished by the Contractor.

B. All material shall be free from defects impairing strength and durability and be of the quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

C. All pipe and fittings shall be clearly marked with name or trademark of the manufacturer, the batch number, the location of the plant, strength designation and pressure rating.

D. It shall be the sole responsibility of the Contractor to keep on hand extra fittings as he may deem necessary, to make adjustments (both vertical and/or horizontal) due to unknown obstructions, without delay to the project.

E. Shop Drawings and Catalog data will be required for each item listed below.

   1. Pipe, fittings and joints

   2. Valves

PART 2 - PRODUCTS

2.1 GENERAL

All materials shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

2.2 POLYVINYL CHLORIDE PLASTIC PIPE, 4-INCH DIAMETER AND LARGER – (PVC 1120 PIPE, CLASS 150)

Pipe shall be virgin polyvinyl chloride (PVC) pipe for potable water. The pipe shall conform to ANSI/AWWA Standard C900, latest edition, for use in sizes 4 inches up to and including 12-inches in diameter. Pipe is to be manufactured to cast iron pipe equivalent outside diameter.

The pipe shall be designed to pass a sustained pressure test of 500 psi in conformance with ASTM D1598 and for a quick burst test of 755 psi in conformance with ASTM D1598. Pipe shall have an elastometric gasket bell end with a thickened wall section integral with the pipe.
barrel in accordance with ASTM D3139, latest edition. The use of solvent weld pipe shall not be allowed. Pipe material shall be clean, virgin, class 12454-A or 12454-B PVC compound conforming to ASTM D3139, latest edition. In any case of conflict between Standards specified herein, AWWA Standard C900 shall prevail. The pipe shall be “Ring-Tite,” Class 150 as manufactured by Johns Mansville, “Supper Bell-Tite,” Class 150, as manufactured by Clow or approved equal.

2.3 POLYVINYL CHLORIDE PLASTIC PIPE, LESS THAN 4-INCH DIAMETER - (SCHEDULE 80 PVC)

PVC pipes less than 4 inches in diameter shall be Schedule 80 polyvinyl chloride meeting ASTM D-1784. Diameters and wall thickness shall comply with ASTM D-1785. Maximum operating pressure shall be 150 psi at 100 degrees F.

2.4 JOINTS AND FITTINGS

A. Restrained Joint

1. Restrained push-on joint pipe and fittings shall be ductile iron with a boltless or semi-boltless method of joint restraint, which permits deflection after assembly. A method of restraining field cut pipe, restraining connection of restrained joint pipe with conventional pipe, or restraining plugs shall be provided for approval by engineer.

2. Pipe and fittings shall be Super-Lock F-128 Pipe and Fittings manufactured by Clow Corporation, TR Flex Pipe and Fittings manufactured by U.S. Pipe, Loc-Ring Pipe and Fittings as manufactured by American Ductile Iron Pipe, or approved equal.

3. Pipe and fittings shall be furnished with all necessary gaskets, lubricant and locking accessories.

4. The joint shall comply with ANSI A21.11 for push-on joints and be designed for a water working pressure of 250 psi.

5. Axial joint restraint shall be provided by a boltless or semi-boltless means, which is locked against accidental disengagement of the restraining components. The joint shall be capable of being disassembled without damage to any of the components.

6. All structural joint components (bell, lock ring and retainer) shall be ductile iron meeting the physical requirements of ANSI A21.10 or approved equal materials. Except for field cut pipe, all structural joint components shall be shipped assembled on the pipe.

7. The joint shall be designed so that there is uniform distribution of thrust forces around the full circumference for all angles of joint deflection. The joint shall be capable of minimum allowable deflections as follows:

<table>
<thead>
<tr>
<th>Size</th>
<th>Minimum Allowable Deflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”</td>
<td>1.0 degrees</td>
</tr>
<tr>
<td>6”</td>
<td>2.0 degrees</td>
</tr>
<tr>
<td>8”</td>
<td>2.5 degrees</td>
</tr>
<tr>
<td>10”</td>
<td>3.0 degrees</td>
</tr>
</tbody>
</table>
B. Mechanical Joint

1. All underground fittings shall be Class 150 minimum, mechanical joint, and shall conform to ANSI A21.10, latest edition where applicable as to thickness and radius of curvature, but not as to length.


3. Mechanical joint gaskets shall be of a composition suitable for exposure to sewage, sludge or scum within the pipe.

4. Where so indicated, pipe and fittings shall be furnished with approved lugs or hooks cast integrally for use with bolts or tie rods and socket clamps to keep the piping from pulling apart under pressure.

C. Flanged Fittings

1. Flanges shall be drilled and faced in accordance with American Standard B16.1, Class 125. Screwed flanges shall be screwed in tight at the foundry by machine before they are faced and drilled. Flanges and flanged fittings shall conform to 125-pound American Standard except that special drilling or tapping shall be as necessary to ensure correct alignment and bolting. Flanges for flanged fittings, and flanged specials shall be integrally cast at right angles to the axis, accurately faced, and filled smooth and true.

2. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same American Standard as the flanges. Bolts and nuts shall be Grade B conforming to the ASTM Designation A307, latest, for Steel Machine Bolts and Nuts and Tap Bolts. Bolt studs and nuts shall be of the same quality as machine bolts.

3. Full faced type rubber gaskets, 1/16-inch thick, shall be used in all flanged joints.

4. Flanged joints shall be made up tight, care being taken to prevent undue strain upon pump nozzles, valves and other pieces of equipment. Bolts shall be tightened so as to distribute evenly the stress in the bolts and bring the pipe in alignment.

5. The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and frilling, such rings shall conform to 125-pound American Standard. Filling rings shall be of suitable length, with nonparallel faces and corresponding drilling, if necessary, to ensure correct assembly of the adjoining piping.

D. Non Standard Fittings

Fittings having non-standard dimensions fabricated especially for this project shall be of approved design. They shall be manufactured to meet the requirements of the same specifications and shall have the same diameter and thickness as standard fittings, but their laying lengths and types of ends shall be determined by their positions in the pipelines and by the particular piping to which they connect.
2.5 INDEPENDENT TESTING LABORATORY REPRESENTATION

All testing specified herein including the slit test, the lining thickness test, and the holiday test shall be witnessed by a representative from an approved independent testing laboratory. Manufacturer must submit for approval by the Engineer the name of the testing laboratory and actual qualifications of the actual representative that will witness the testing. The manufacturer shall furnish three (3) copies of the report by independent testing laboratory depicting results of all testing witnessed by the independent laboratory.

Each pipe and fitting shall be inspected in the field by the Owner’s representative for conformance to these specifications prior to installation. Any defects as specified herein with any pipe or fittings shall be grounds for rejection. Field testing will be conducted at the expense of the contractor in the case of a dispute.

2.6 POLYETHYLENE ENCASEMENT FOR DUCTILE IRON PIPE

This specification covers materials and installation procedures for polyethylene encasement to be applied to underground installations of ductile iron pipe. This specification also shall be used for polyethylene encasement of fittings, valves and other appurtenances to ductile iron pipe systems. Polyethylene encasement shall be installed to the limits as shown on the drawings.

A. Definitions

1. Polyethylene Encasement
   Ductile iron pipe shall be encased with polyethylene material, either in a tube or sheet form.

2. Securing Overlap
   Any one of the various methods of holding polyethylene encasement in place at the point of overlap until pack-filling operations is completed. This may be accomplished with adhesive tape, plastic string or other suitable material.

B. Materials

1. Polyethylene
   Polyethylene encasement materials shall be manufactured of virgin polyethylene possessing the characteristics shown in Table 1.
Table 1

<table>
<thead>
<tr>
<th>Type, Class, Grade, Other Characteristics</th>
<th>In Accordance with ASTM Specifications D1248-72 or latest revision thereof</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>I</td>
</tr>
<tr>
<td>Class</td>
<td>A (Natural Color) or C Black</td>
</tr>
<tr>
<td>Grade</td>
<td>E-1</td>
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<tr>
<td>Flow Rate (formally Melt Index)</td>
<td>0.4 Maximum</td>
</tr>
<tr>
<td>Dielectric Strength</td>
<td>Volume resistivity, minimum Ohm-Cm² = 10⁻¹⁵</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>1,200 psi minimum</td>
</tr>
<tr>
<td>Elongation</td>
<td>300% minimum</td>
</tr>
<tr>
<td>Dielectric Strength</td>
<td>800 volts per mil thickness minimum</td>
</tr>
</tbody>
</table>

2. Thickness
Polyethylene material shall have a minimum nominal thickness of .008" (8 mils) the minus tolerance on thickness shall not exceed 10% of the nominal thickness.

3. Tube size
The tube size for each pipe diameter shall be as listed in Table 2 below.

Table 2

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter (Inches)</th>
<th>Recommended Polyethylene Flat Tube Width (inches)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
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<td>5</td>
<td>20</td>
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<td>14</td>
<td>34</td>
</tr>
<tr>
<td>16</td>
<td>37</td>
</tr>
<tr>
<td>18</td>
<td>41</td>
</tr>
</tbody>
</table>

*For flat sheet polyethylene see Paragraph 6.4.2.3

C. Installation

1. General
Polyethylene encasement shall be installed on pipe and fittings at the locations specified on the construction drawings. Although not intended to be a completely air and watertight enclosure, the polyethylene shall prevent contact between the pipe and the surrounding backfill.

2. Pipe
This standard includes three different methods for the installation of polyethylene encasement. Methods A and B are for use with polyethylene tubes and Method C is for use with polyethylene sheets.
a. Method A: Cut polyethylene tube to a length approximately 2-foot longer than the length of the pipe section. Slip the tube around the pipe, centering it to provide a 1-foot overlap in each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends.

Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube.

After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe and secure in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

Repair any rips, punctures, or other damage to the polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in the same manner.

b. Method B: Cut polyethylene tube to a length approximately 1 foot shorter than the length of the pipe section. Slip the tube around the pipe, centering it to provide 6 inches of bare pipe at each end. Make polyethylene snug, but not tight, secure end as described in Method A above.

Before making up a joint, slip 3-foot length of polyethylene tube over the end of the preceding pipe section, bunching it accordion fashion lengthwise. After completing the joint, pull the 3-foot length of polyethylene over the joint, overlapping the polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least one foot; make snug and secure each end as described in Method A above.

Repair any rips, punctures, or other damage to the polyethylene as described in Method A above. Proceed with installation of the next section of pipe in the same manner.

c. Method C: Flat sheet polyethylene shall have a minimum width twice the flat tube width shown in Table 2.

Cut polyethylene sheet to a length approximately 2 feet longer than the length of pipe section. Center the cut length to provide a 1-foot overlap on each adjacent pipe section, bunching it until it clears the pipe ends. Wrap the polyethylene around the pipe so that it overlaps circumferentially over the top quadrant of the pipe. Place a 6-inch length of adhesive tape at approximately 3-foot intervals along the pipe length, securing the cut edge of polyethylene sheet.

Lower the wrapped pipe into the trench and make up the pipe joints with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene. After completing the joint, make the overlap as described in Method A above.
Repair any rips, punctures, or other damage to the polyethylene as described in Method A above. Proceed with installation of the next section of pipe in the same manner as Method A above.

3. Odd-Shaped Appurtenances
   Valves, tees, crosses, and other odd-shaped pieces, which cannot practically be wrapped in a tube, shall be wrapped with a flat sheet or split length of polyethylene tube. The sheet shall be passed under the appurtenance and brought up around the body.

   Seams shall be made by bringing the edges together, folding over twice, and taping down. Slack width and overlaps at joints shall be handled as described in Method A above. Tape the polyethylene securely in place at valve stems and other penetrations as in Method A above.

4. Pipe-Shaped Appurtenances
   Bends, reducers, Offsets and other pipe-shaped appurtenances shall be covered with polyethylene in the same manner as the pipe.

5. Openings in Encasement
   Openings for branches, service taps, blowoffs, air valves, and similar appurtenances shall be made by making an x-shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape.

6. Junctions Between Wrapped and Unwrapped Pipe
   Where polyethylene wrapped pipe joins a pipe, which is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least 2 feet. Secure the end with circumferential turns of tape.

7. Backfill For Polyethylene Wrapped Pipe
   Backfill material shall be the same as specified for pipe without polyethylene wrapping. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill.

2.8 PVC PIPE FOR TREATED WASTEWATER EFUENT

   All pipe to be used for conveyance of treated wastewater effluent shall conform to Paragraph 2.3 of the Specification except that the pipe shall be purple or lavender in color. Pipe shall be as manufactured by J.M. Pipe or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

   Pressure lines shall be laid with not less than 36 inches cover. Cover for pipe under pavement shall be measured from the bottom of the base material. Greater depth will be permitted where required to miss obstructions or for the proper installation of valves. Lines shall be located generally as shown on the drawings. Lines shall be laid to a grade which will permit entrapped air to flow to a high point for release through an air release valve as shown on the drawings. Investigate well in advance of pipe laying any conflicts, which may require re-adjustments in planned locations. Advise the Engineer of the results of these investigations so that he may give instructions as to the modifications required.
3.2 LAYING PIPE

The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during construction by means of plugs or other suitable methods. No trench water shall be allowed to center the pipe or fittings. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end last laid to prevent mud or other foreign material from entering the pipe. Lines shall be laid reasonably straight, and any change in grade in following the contour of the ground shall be made in long sweeping curves. Abrupt changes in grade will not be permitted except as indicated on the drawings or approved by the Engineer. Fittings in the lines shall be braced with concrete thrust blocks at points of unbalanced reactions.

3.3 JOINTS

Type of joint use shall be approved by the Engineer prior to installation. Joints shall be made in accordance with approved printed instructions of the manufacturer, and shall be absolutely watertight.

3.4 THRUST BLOCKING

Restrained Joints shall be placed at all points of unbalanced reaction on the piping. Anchors and thrust blocks shall bear against the undisturbed earth of the trench wall and have a minimum-bearing surface as shown on the drawings.

3.5 INSPECTION AND TESTING

A. All pipe fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. The Contractor shall furnish in triplicate to the Engineer sworn certificates of such tests.

B. Pipes and fittings shall be subjected to a careful inspection and hammer test made on all iron pipe just before being laid of installed. Defective pipe of fittings shall be immediately removed and replaced with sound material.

C. Prior to pressure and leakage tests, all piping shall be thoroughly cleaned of all dirt, dust, oil, grease and other foreign matter. This work shall be done with care to avoid damage to any inside coating.

D. All lines shall be thoroughly flushed with clean water to clear all lines of foreign matter.

3.6 FIELD TESTING

A. All field tests shall be made in the presence of the Engineer. Except as otherwise directed, all pipelines shall be tested. Pipelines laid in excavation (other than trench excavation), shall be tested prior to the backfilling of the excavation.

3.7 HYDROSTATIC TESTING

A. All piping to operate under liquid pressure shall be tested in sections of approved length. For these tests the Contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment, and all labor required without additional compensation. The Contractor will furnish suitable pressure gauges, calibrated by an approved testing laboratory,
with increments no greater than 2 psi. Gauges used shall be of such size that pressures tested will not register less than 10% or more than 90% of the gauge capacity.

1. Unless it has already been done, the section of pipe to be tested shall be filled with water of approved quality and all air shall be expelled from the pipe. If blowoffs or other outlets are not available at high points for releasing air, the Contractor shall make the necessary taps at such points and shall plug said holes after completion of the test.

2. Hydrostatic testing shall consist of both pressure tests and leakage tests. Pressure tests shall be of one-hour duration and leakage tests shall be of a two-hour duration, unless otherwise specified or notified in writing by the Engineer. Test pressures shall be as set forth hereinafter. Specified test pressures, based on the elevation of the highest point of the line or section under test, and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. Pressure specified shall be of the minimum pressure applied to the line or section under test. The pump, pipe connection, and all necessary apparatus, including the proper gauges shall be furnished by the Contractor and shall be subject to the approval of the Engineer.

3. Pressure tests shall be conducted with a pressure loss of not more than two pounds per square inch regardless of length being tested. All exposed pipe, fittings, valves and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings or valves that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory and at no additional cost to the Owner.

4. Leakage tests shall be conducted subsequent to the pressure tests. Leakage is defined as the quantity of water that must be supplied to the line or section under test to maintain constant pressure throughout the duration of the test. No pipe installation will be accepted if the leakage is greater than determined by the following formula from ANSI/AWWA C600-77:

\[ L = \frac{NDP}{7400} \]

In which \( L \) is the allowable leakage in gallons per hour; \( N \) is the number of joints in the length of pipeline tested; \( D \) is the nominal diameter of the pipe, in inches; and \( P \) is the average test pressure during the leakage test, in pounds per square inch. If any test discloses leakage greater than that specified above, the Contractor shall, locate and repair the defective material and retest until the leakage is within the specified allowance at his own expense.

B. In the event a section fails to pass the tests, the Contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section), and repair or replace the defective pipe, fitting or joint. Visible leaks shall be corrected regardless of total leakage.

Lines, which fail to meet these tests, shall be repaired and retested as necessary until test requirements are compiled with. All testing shall be performed at no additional cost to the Owner.
C. If, the judgment of the Engineer, it is impracticable to follow the foregoing procedures exactly for any reason, modifications in the procedure shall be made as required or approved; but, in any event, the Contractor shall be responsible for the ultimate tightness of the piping within the above requirements.

D. Test Pressures:

All piping shall be pressure tested for a minimum of one-hour duration at 150 psig and leakage tested for a minimum of two-hour duration at 100 psig.

3.8 SURVEYS AND GRADE STAKES

A. The Contractor shall be responsible for setting all grade stakes, lines, and levels. The Owner will establish a benchmark.

B. All grade and alignment stakes for construction under this project shall be set by a land surveyor registered to practice in the State of Florida and all costs thereof shall be borne by the Contractor. The requirement for this work to be accomplished by a registered land surveyor may be waived by the Engineer in the event the Contractor desires to utilize his own personnel and furnishes, in writing to the Engineer, satisfactory evidence that his personnel are qualified to set the grade and alignment stakes. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes.

END OF SECTION
SECTION 02592

VALVE BOXES

PART 1 - GENERAL

1.1 SCOPE OF WORK

Provide all labor, materials, equipment and services required to furnish and install valve boxes at valve locations shown on the drawings, designated by the ENGINEER, and/or specified herein.

1.2 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the ENGINEER for review before ordering.

B. A letter of certification shall be provided by the manufacturer to the ENGINEER stating compliance with these specifications.

C. At the time of submission, the CONTRACTOR shall, in writing, call ENGINEER's attention to any deviations that the submittals may have from the requirements of the ENGINEER's Contract drawings and specifications.

PART 2 - PRODUCTS

2.1 VALVE BOXES:

A. Valve boxes shall be installed for all valves installed underground. Only telescoping valve boxes manufactured of cast iron or Class 160 PVC will be allowed. Cast iron casting shall be manufactured of clean, even grain, gray cast iron with a minimum tensile strength of 21,000 psi. The valve box shall be smooth, true to pattern, free from blowholes, sand holes, projections and other harmful defects.

B. Valve boxes shall have a minimum 5-1/4 inch shaft. Cast iron valve boxes shall have a weight of at least 60 pounds and a wall thickness of at least 1/4". Valve boxes shall be of two-piece design including bottom section and top section with lid and shall be adjustable to fit the depth of earth cover over the valve. Three-piece valve boxes will be allowed for excessively deep valves.

C. Valve boxes shall be accurately centered over valve operating nuts, and backfill shall be thoroughly tamped around them. They shall be set vertically plumb and properly adjusted so that the tops of boxes will be at grade in any paving, walk, road or ground surface.

D. Valve boxes shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes inside paving, walks, or road surfaces shall not be set on the valves but shall be supported on crushed stone fill.

E. The seating surface of both the lid cover and the top section of the valve box shall be made so the cover will not rock after it has been seated and will fit tightly with little or no play in the fit. Valve boxes shall have the word "SEWER" cast into the covers.
F. Wherever valve boxes fall outside of the roadway pavement, the top of the box shall be set in a concrete slab 24" x 24" x 6" thick (or 24" circular x 6" thick) with the top of the slab and box flush with the top of the ground. This provision shall apply to all new and all existing valve boxes which fall within the limits of the Contract, unless otherwise stated on the plans or ordered by the ENGINEER.

G. Valve boxes shall have extension stems, where necessary, when operating nut is raised to be within 4 feet of the existing grade. Extensions must be securely attached to the operating nut so the shaft will not pull off of the operator.

PART 3 - BASIS OF PAYMENT

3.1 PAYMENT

The cost for valve boxes is not a pay item. The cost of valve boxes and concrete slabs is part of the Contract’s lump sum price.

END OF SECTION
SECTION 02823

SEEDING AND MULCHING

PART 1 - GENERAL

1.1 SCOPE

The work specified in this section consists of establishing a stand of grass by grassing areas indicated on the plans and identified in the specifications.

The work shall include:

Seeding of the WWTP fenced in areas and disturbed areas within the site and buffer zone areas.

Fertilization of all new seeded areas.

Watering of seeded areas until grass is established and accepted by owner.

Maintenance of all seeded areas during the contract.

1.2 REGULATORY REQUIREMENT

Comply with regulation agencies for fertilizer, herbicide, pesticide and seed mixture composition requirements.

1.3 COORDINATION

Coordinate the work under this section with all site improvement work and the installation of the trees, plants and ground cover beds and/or locations as is necessary minimize the duplication of and protection of site improvements.

1.5 MAINTENANCE

Maintain all seeded and sodded areas immediately after placement, until grass is well established and exhibits a vigorous growing condition. Contractor is responsible for maintenance and repair specified under part 3 of this specification section for a minimum of thirty (30) days after the final acceptance of work.

1.7 JOB CONDITIONS

Inspection of the site:

A. The contractor shall visit the site and acquaint himself with all existing conditions.

B. Protection of existing vegetation and site improvements:

The contractor shall take necessary precautions to protect all existing vegetation and site improvements to remain. Should damage be incurred, the contractor shall repair the damage to its original condition at his own expense.
1.8 EQUIPMENT

A. Seed spreader:

The seed spreader shall be an approved mechanical spreader or other approve type of spreader.

B. Equipment for cutting mulch into soil:

The mulching equipment shall be capable of cutting the specified materials uniformly into the soil and to the required controlled depth. Harrows will not be allowed.

C. Rollers:

Cultipacker, traffic roller, or other suitable equipment will be required for rolling the grassed areas.

PART 2 - PRODUCTS

2.1 SEED

Seed shall be fresh, clean, dry, and shall be certified as to varietal purity. All seed shall mixed by a dealer, furnished in sealed standard containers and tagged with the dealer’s guaranteed statement of composition of mixture and percentage of moisture, purity and germination. The seed shall be labeled in accordance with the state, department of agriculture and consumer services rules and regulations, and in accordance with the florida certification seed law in effect at the time of work.

Grass seed shall be pensacola bahia, having a minimum pure seed content of 97%, with minimum germination rate of 85%. Temporary grass seed shall be rye grass, with 40%, minimum germination.

2.2 MULCH

The mulch material used shall normally be dry mulch. Dry mulch shall be straw or hay, consisting of oat, rye or wheat straw, or of pangola, peanut, coastal bermuda or bahia grass hay. Only undeteriorated mulch, which can be readily cut into the soil, shall be used.

2.3 FERTILIZER

Fertilizer shall be 12-8-8 (12% total nitrogen, 8% available phosphoric acid, 8% water soluble potash) and at least 50% of the available phosphoric acid shall be from normal super phosphate or an equivalent source that will provide two (2) units of sulfur.

2.4 WATERING

Newly seeded areas are not to be watered to force seed germination but only to sustain grass growth. Water will only be used on vegetated areas when permitted by engineer the water used in grassing operations may be obtained from any approved spring, pond, lake, stream, or municipal water system. The water shall be free of excess and harmful chemicals, acids, alkalines, or any substance that might be harmful to plant growth or obnoxious to traffic. Salt water shall not be used.
2.5 DELIVERY, STORAGE AND HANDLING:

Contractor shall notify engineer, in advance, when seed is to be delivered. Seed, which does not meet specifications for quality and species herein stated and arrives in an unsatisfactory condition, shall be removed immediately and disposed of by contractor replaced by him without additional compensation.

During delivery, prior to and during the planting of the irrigation area, the seed shall at times be protected from excessive drying and unnecessary exposure.

PART 3 - EXECUTION

3.1 GENERAL

Seeding or mulching operations will not be permitted when wind velocities exceed 15 mile per hour. Seed shall be sown only when the soil is moist and in proper condition to induce growth. No seeding shall be done when the ground is unduly wet, or otherwise not in a tillable condition.

3.2 SEQUENCE OF OPERATIONS

The several operations involved in the work shall proceed in the following sequence: preparation of the ground, seeding, spreading of mulch, cutting-in of mulch and rolling.

3.3 PREPARATION OF AREA TO BE SEEDED

The ground to be seeded shall be prepared by disc harrowing and thoroughly pulverizing the soil to a suitable depth. The prepared soil shall be loose and reasonably smooth. It shall be reasonably free of large clods, roots and other material, which will interfere with the work and subsequent mowing and maintenance operations.

3.4 SEEDING

While the soil is still/loose and moist, the seed shall be scattered uniformly over the grassing area at a rate of 100 pounds per acre.

3.5 MULCHING

Approximately 2 inches, loose thickness of the mulch material shall be applied uniformly over the seeded areas specified on the construction plans, and the mulch material cut into the soil with the equipment specified, so as to produce a loose mulched thickness of 3 to 6 inches. Care shall be exercised that the materials are not cut too deeply into the soil.

When green mulch is used, it shall be incorporated into the soil no later than 2 days after being cut and no artificial watering of the mulch shall be done before it is applied.

3.6 ROLLING

Immediately after completion of the seeding, the entire seeded area and se mulched areas shall be rolled thoroughly with the equipment specified. All over the entire area will be required.

END OF SECTION
SECTION 03100

CONCRETE WORK-GENERAL

PART 1 - GENERAL

1.1 SCOPE

The work under this section includes all materials, equipment and labor, and performing all operations for constructing the concrete work including lightweight concrete as shown on the drawings, called for herein, or necessary for the proper completion of the work, in accordance with these Specifications and to the lines, notes, and dimensions indicated on the drawings or specified herein.

1.2 GENERAL REQUIREMENTS

A. Whenever a standard, regulation or code is referenced in these Specifications without an indication of the edition or date thereof, the edition or date applicable shall be the one in effect on the date shown on the title page of these Specifications.

1. ASTM means the standard or specification published by the American Society for Testing and Materials.

2. ACI means the standard, code or specification published by the American Concrete Institute.

B. All concrete shall be proportioned, mixed, placed, finished and cured in accordance with the requirements of ACI 301, as modified herein, except that concrete for pavement including sidewalks, curbs and gutters and driveways shall be placed, finished and cured in accordance with ACI 617.

1.3 PLANT APPROVAL

The Engineer or his authorized representative shall have the right and shall be afforded any facility to inspect the plant where concrete is batched including material used, and methods of proportioning, mixing and delivery of concrete; all of which shall be in accordance with the Specifications and meet the approval of the Engineer. No ready-mixed concrete shall be ordered until the Engineer has given his approval thereof.

1.4 TEST SAMPLES

A. The Owner will retain a testing laboratory to act as its representative in the sampling and testing of concrete furnished. Cost of the services of the laboratory will be borne by the Owner with payment thereof made directly to the laboratory. The laboratory's inspectors shall have free access to all points where concrete materials are stored, proportioned, mixed or placed. The Contractor shall provide on-site facilities as needed by the laboratory to secure and store samples.

B. For each twenty (20) cubic yards or portion thereof of each class of concrete placed each day, the laboratory shall take a sample from a batch of its selection as the concrete is being placed. No water shall be added or other change made in any batch after it has been sampled. In addition
to other tests, the laboratory will make a set of three (3) standard compression cylinders from each sample, one (1) of which will be tested at seven (7) days and two (2) tests at twenty-eight (28) days. The Contractor will be furnished with a report of each test made. Testing of concrete at other times as needed by the Contractor will be at his expense, and the Engineer shall be furnished with a report of all such tests made.

C. The Contractor shall advise the laboratory within twenty-four (24) hours advance notice of the time and location of all concrete placing or otherwise make arrangements with the laboratory so that samples may be obtained.

D. Compression strength of a sample shall be determined by the average of the two (2) cylinders tested at twenty-eight (28) days. Compliance with the strength requirements of these Specifications shall be verified if the average strength of three (3) consecutive samples is not less than the specified strength for the class of concrete, provided no individual sample shall have a strength test result that falls below the specified strength by more than five hundred (500) psi.

E. Concrete, which fails to meet strength requirements, may be further tested as provided in ACI 318 at the expense of the Contractor, or shall be removed as determined by the Engineer.

F. The Engineer may waive testing requirements on small quantities or concrete elements where strength is not critical.

1.5 CONCRETE QUALITY

A. Concrete shall have the following minimum compressive strengths when tested at twenty-eight (28) days in accordance with ASTM C 172, ASTM C31, and ASTM C39:

<table>
<thead>
<tr>
<th>Class</th>
<th>Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>4,000 psi</td>
</tr>
<tr>
<td>Class C</td>
<td>2,500 psi</td>
</tr>
<tr>
<td>Class P</td>
<td>5,000 psi</td>
</tr>
</tbody>
</table>

B. Unless otherwise specified or noted, class of concrete shall be as follows:

- Pre-stressed structural elements: Class P
- Sidewalks, curb and gutter, splash blocks, Cradles, encasements, thrust blocks, and other non-structural concrete as approved by the Engineer: Class C
- All other concrete: Class A

Class A concrete may be used at the option of the Contractor wherever Class C is specified, but at no additional cost to the Owner.

C. Concrete when placed shall be of a plastic consistency such that it can be readily worked into all parts of the forms and around embedded items without segregation of materials and accumulation of free water on the surface. Except as specified otherwise for special finishes, slump as measured in accordance with ASTM C143 shall be as follows:
Air entrainment, as determined in accordance with ASTM C173, of not less than four (4) percent nor more than six (6) percent by volume shall be provided in Class A concrete and may be provided in Classes C and P.

PART 2 - PRODUCT

2.1 MATERIALS - GENERAL

Except where specifically noted otherwise, all concrete shall be ready-mixed, normal weight, as produced by a plant acceptable to the Engineer. Job mixed concrete may be used for small quantities upon specific approval of the Engineer. Lightweight concrete shall be as specified in the paragraph herein entitled, "Vermiculite Fill".

2.2 CEMENT

A. Cement shall be a single brand of approved American made Portland cement conforming to ASTM C150. All cement shall be gray in color including cement for concrete to receive special finishes.

B. Air-entraining cement shall not be used.

C. Unless otherwise noted, Type I (normal) cement shall only be used in precast prestressed elements; lightweight concrete; concrete cradles; encasements and thrust blocks; concrete fill other than in tanks containing sewage; concrete cast-in-place piling; concrete pavement, sidewalks, curbs, gutters and driveways.

D. Unless otherwise specified, Type II (sulfate-resistant) Portland cement shall be used in all other concrete and may be used where Type I is specified.

E. Type III (high-early-strength) cement may be used only with the written permission of the Engineer, but no additional payment will be made to the Contractor for the use thereof.

F. In addition to the requirements of ASTM C150, cements to be used in exposed concrete shall exhibit no efflorescence when tested in accordance with the ASTM C67, but employing two-inch by seven-inch by 1/2-inch (2-inch x 7-inch x Y2-inch) mortar slabs comprising a one to three (1:3) mixture by weight of the cement in question and Ottawa Sand, mixed with local tap water to a flow of one hundred (100) percent and aged one (1) week before test.

G. All cement to be used in the work shall be subject to testing to determine conformity to the requirements of the Specifications. The methods of testing shall conform to the appropriate Specifications, but the Engineer in accordance with the particular conditions of this Project will determine the place, time, frequency and method of sampling. If required by the Engineer, the Contractor shall furnish sworn certificates of mill tests of cement at least seven (7) days before the cement will be used. The Owner reserves the right to make such independent tests as he may deem necessary at any time.

H. Cement which is partially set or which is lumpy or caked shall not be used, and the entire contents of the sack of cement or the container of bulk cement, which contains damaged, partially set, or lumps of caked cement will be rejected for use.
2.3 AGGREGATES

A. All aggregates shall conform to ASTM C33.

B. Fine aggregate shall be washed natural sand, clean, sound, sharp, screened and well graded with no grain larger than will pass a No. 4 sieve. Not less than Fifteen (15) percent or more than thirty (30) percent by weight shall pass a No. 50 sieve. No fine aggregate shall be used if it contains more than one (1) percent by weight of deleterious substances, or which shows a color darker than Plate 2 when tested according to the ASTM C40.

C. Coarse aggregate shall be washed, hard, tough and durable screened gravel or crushed stone having no more than five (5) percent by weight of deleterious substances and soft fragments.

Aggregate shall be well graded from the largest, which shall pass a one-inch (1-inch) mesh to the smallest, which shall pass a 3/8-inch mesh and be retained by a 1/4-inch mesh. Abrasion loss shall not exceed the percentages contained in ASTM C33 when tested in accordance with the procedures outlined therein. No coarse aggregate shall be used if it contains more than one (1) percent silt or which shows the color darker than Plate 1 when tested as above specified for fine aggregate.

D. When directed, the Contractor shall furnish clearly labeled samples of aggregates to the Engineer.

2.4 ADMIXTURES

Admixtures causing accelerated setting of cement in concrete or containing chloride ions shall not be used. Admixtures to provide air entrainment shall conform to ASTM C260 and shall be approved by the Engineer. No other admixture shall be used except with the specific approval of the Engineer.

2.5 WATER

Mixing water for concrete shall be clean, fresh and suitable for drinking and shall not contain injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances, except as specifically approved otherwise by the Engineer.

2.6 BONDING AGENCY

Where new concrete is to be placed against existing concrete (concrete more than ninety (90) days old), the existing concrete surface shall be coated with a bonding agent prior to placing concrete. Bonding agent shall be Welded-Crete as manufactured by Larsen Products Corporation, or equal. Application shall be in strict accordance with manufacturer's recommendations.

2.7 NON-SHRINK GROUT

Non-shrink grout shall be a proprietary type grout composed of pre-mixed grouting cement, aggregates and appropriate additives to which only the water needs to be added at the site to produce the finished product. The amount of water to be added shall be the minimum required for the intended purpose (depending on whether it is a dry-pack or self-leveling application) and it shall be in accordance with the manufacturer's instructions. The grout shall be specially
formulated to make it absolutely non-shrink and the supplier shall be able to furnish test data from an independent testing laboratory proving their grout to be non-shrink under the conditions of usage anticipated. It shall also be a grout that will have a seven-day (7-day) strength equal to that specified for Class P concrete. The grout shall be placed in a manner that will insure complete filling in of holes under base plates and complete contact with the plates. Exposed surface of the non-shrink grout shall be such that it is not subject to corrosive erosion or staining, due either to its composition or to protection provided. The grouting materials, test data pertaining to them, and methods of installation shall be submitted for approval to the Engineer during the Shop Drawing submittal period. Approved for this material are Embeco 636 Grout and/or Masterflow 713 Grout as manufactured by the Masters Builders Company, or equal.

2.8 VERMICULITE FILL

Wherever lightweight concrete is shown on the drawings, it shall be held to mean insulating concrete using aggregate conforming to ASTM C332 and Portland cement conforming to ASTM C150, Type I, mixed and placed in accordance with recommendations of the Zonolite Division of W.R. Grace Company. Lightweight concrete shall be mixed in the proportion of one (1) part Portland cement and six (6) parts vermiculite aggregate by volume and shall develop a minimum compressive strength of one hundred twenty-five (125) psi. Lightweight concrete roof fill to be ventilated by means of removable metal vents. Lightweight concrete supplier to provide Zonolite, or equal, roofing nails.

PART 3 - EXECUTION

3.1 CONCRETE PROPORTIONS

A. Materials used in concrete shall be proportioned in accordance with ACI 211.1 and approved by the Engineer as provided in Paragraph 3.1.2. Class A concrete shall be proportioned to provide a water/cement ratio not to exceed 0.45 and a cement content of not less than five hundred sixty-four (564) pounds per cubic yard.

B. Submit to the Engineer for approval, not less than seven (7) days before, concrete is to be placed, a report certified by an independent testing laboratory containing the following:

1. Recommend proportions of materials to be used in concrete;

2. Result of testing of all materials in accordance with ASTM specifications including sieve analysis, specific gravity and dry-rodded volume of aggregates;

3. Result of testing laboratory trial batches in accordance with ASTM C39 and C 192.

C. All testing and analysis of materials shall have been done not more than four (4) months prior to the date of submission. The certified report shall state the date thereof.

D. Proportions of materials shall be based on accurate measurements thereof by weight taken separately.

3.2 MIXING AND DELIVERY

A. Ready-mixed concrete shall be used. All mixing requirements specified herein shall be enforced. The Owner’s laboratory representative and the Engineer shall have free access to the mixing plant at all times. Except for material and/or procedure otherwise specified herein,
ready-mixed concrete shall be mixed and delivered in accordance with the requirements of ASTM C94. No water shall be added to the concrete after it leaves the plant except as specifically approved by the Engineer, and it shall be so noted on the batch ticket.

B. Neither the speed of any mixer nor the quantity of material loaded into any mixer shall exceed the recommendations of the manufacturer. Excessive mixing, requiring additions of water to preserve the required consistency, shall be cause for rejection of the batch. Concrete shall not remain in a transit mixer or agitator truck more than ninety (90) minutes after the water is introduced (and not more than forty-five (45) minutes if an approved retarding agent is not used). Minimum mixing time shall be fifty (50) revolutions of drum at rate speed.

C. Equipment necessary to determine and control the actual amounts of all materials entering the concrete shall be provided by the concrete manufacturer. All material shall be measured by weight, except that water may be measured by volume calculated at 8-1/3 pounds per gallon. One bag of cement will be considered as ninety-four (94) pounds in weight.

D. Accompanying each batch of concrete delivered to the site shall be a ticket that shall indicate the following information:

1. time mix was batched stamped on ticket
2. brand and type of cement
3. bags of cement per cubic yard of concrete
4. planned slump
5. admixture, and
6. name of supplier.

These tickets shall be given to the Owner's Project Representative when the truck arrives on the job.

E. Attention is directed to the importance of dispatching trucks from the batching plant so that they shall arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting. Concrete shall be discharged into forms not more than ninety (90) minutes after water was first added to the mix, and shall be mixed at least five (5) minutes after all water has been added.

3.3 FORMS

A. Forms shall be securely braced, substantial and unyielding, and of sufficient strength to hold the concrete without bulging between supports, or without deviation from the neat lines as shown on the Plans. Forms shall be mortar tight and shall be constructed of pre-fabricated metal, plywood or dressed lumber of uniform thickness with or without a form liner.

B. The spacing of joists and wales shall be such as to prevent warp and bulging and to produce true and accurate surfaces. All lumber shall be free from knot holes, loose knots, cracks, splits, warps or other defects affecting its strength or the appearance of the finished concrete surface. Fiber board or other manufactured material, approved by the Engineer, may be used as a lining for forms.

C. The interior surfaces of forms shall be adequately oiled, greased or soaped to prevent adhesion or mortar. Form oil for exposed work shall be non-staining. Before placing of concrete, the forms shall be cleaned of all dirt, sawdust, shavings or other debris, and the surfaces shall be dampened.
D. Special care shall be exercised to secure smooth and tight-fitting forms, which can be rigidly held to line and grade and removed without injury to the concrete. All corners in the finished work shall be true, sharp and clean cut. Alignment of forms and grade of top chamfer strips shall be checked immediately after the placing of concrete in the forms.

E. Forms shall not be removed until the product of the elapsed number of days after placement and the average daily air temperature at the surface of the concrete equals one hundred (100) for walls and vertical surfaces and five hundred (500) for slabs and beam soffits and other parts that support the weight of the concrete.

F. In addition to the above, shores under beams and slabs shall not be removed until the concrete has attained at least sixty (60) percent of the specified cylinder strength and also sufficient strength to support safely its own weight and the construction live loads upon it. Shores under cantilevers shall remain in place at least fourteen (14) days after concrete is placed.

G. Round forms may be constructed of spirally laminated plies of fiber. Total wall thickness shall be as specified by manufacturer with a minimum of six-inch (6-inch) wide plies. Provide polyethylene coating on interior surface. Manufacturer Approved: A-Coated Sonotube.

3.4 EMBEDDED ITEMS

A. All sleeves, inserts, hangers, anchor bolts, dowels, nailing strips or other embedded items shall be accurately set, and firmly held in place while the concrete is deposited. Anchors and ties for masonry shall be provided as shown on the drawings or called for in Division 4, Masonry.

B. Pipes, conduits and other items embedded in the concrete shall be so placed and held that they do not misplace the reinforcing or weaken the concrete at points of maximum stress or where the concrete section is not sufficient to permit the reduction of area caused by the embedment. For water stops, see Section 03251, Expansion and Concrete Joints.

C. Type II polyvinyl chloride plastic 0.060 inches in thickness. Reglets shall be Original Reglet as manufactured by Fry Reglet Corporation, or approved equal.

3.5 PLACING CONCRETE

A. All concrete shall be placed during daylight hours allowing sufficient time for adequately finishing the concrete surfaces during daylight hours. The Contractor shall give the Engineer twenty-four (24) hours notice of intent to place concrete to enable prior inspection of forms and of conditions incidental to the pour. No concrete shall be placed until the forms have been approved by the Engineer and until all the reinforcement is in place and has been inspected and approved by the Engineer. No concrete shall be placed on water, and forms shall be free from water, dirt, debris or any foreign matter when concrete is placed. Normal weather limitations for placing concrete shall be adhered to and no concrete shall be exposed to the action of water before final setting.

B. The method and manner of placing concrete shall be such as to avoid the possibility of segregation or separation of the aggregates. If the quality of concrete as it reaches its final position is unsatisfactory, the method of placing shall be discontinued or adjusted until the quality of the concrete as placed is satisfactory. Open troughs or chutes shall be of metal or metal-lined. Where steep slopes are required, the chutes shall be equipped with baffles or shall be in short lengths that reverse the direction of movement. Where placing operations would involve dropping the concrete freely more than five (5) feet, it shall be deposited through pipes.
of sheet metal or other approved material. Troughs, chutes or pipes with a combined lengths of more than thirty (30) feet shall be used only on written authority from the Engineer. All troughs, chutes and pipes shall be kept clean and free from coatings of hardened concrete by being thoroughly flushed with water after each run or in its final position. Depositing a large quantity at any point and running or working it along the forms shall not be done. Special care shall be taken to fill each part of the forms and to work the coarse aggregate back from the face and to force the concrete under and around the reinforcing bars without displacing them. The concrete consistency as measured by slump shall be as specified herein.

C. Concrete shall be compacted by continuous working with a suitable tool in a manner acceptable to the Engineer, and by vibrating. Vibration shall be done by experienced operators under close supervision, and the duration shall be held to the minimum necessary to produce thorough compaction without segregation. Where vibrators are not used, all thin section work shall be thoroughly worked with a steel slicing rod. All faces shall be well spaded and the mortar flushed to the surface by continuous working with a concrete spading implement acceptable to the Engineer.

D. In all cases where, on account of the obstructions produced by the reinforcing metal, shapes or forms or any other uncontrollable conditions, difficulty is encountered in puddling the concrete adjacent to the forms, the mortar content of the mix shall be brought into proper contact with the interior surfaces by vibrating the forms. The vibrations shall be produced by striking the outside surfaces of the forms with wooden mallets or by other means satisfactory to the Engineer.

E. No concrete placing shall begin or continue without the express approval of the Engineer if the ambient air temperature is less than forty degrees F. (40°F), or is predicted to fall below thirty-six degrees F. (36°F) during the next twenty-four (24) hours or thirty-two degrees F. (32°F) during the next seventy-two (72) hours. Temperature of concrete when placed shall be less than fifty-five degrees F. (55°F). Chemicals to lower freezing temperature of concrete shall not be used.

F. When the ambient air temperature is ninety degrees F. (90°F) or above, the Engineer may require pre-cooling of aggregates with water sprays and scheduling of placing successive layers of concrete so as to cause maximum release and dissipation of heat of setting, or other protective measures. In no case shall the temperature of the concrete, forms or reinforcing exceed ninety degrees F. (90°F) when concrete is being placed and, if necessary, forms and reinforcing shall be cooled by water spray prior to pouring concrete.

3.6 CURING AND PROTECTION

A. All concrete work shall be protected against damage from the elements and displacement of any nature during construction operations. Water shall not be permitted to rise on concrete within twenty-four (24) hours after it is placed, nor shall running water be allowed to flow over completed concrete within four (4) days after it has been placed.

B. All concrete, particularly slabs and including finished surfaces, shall be treated immediately after concreting or cement finishing is completed to provide continuous moist curing for at least seven (7) days, regardless of the adjacent temperature. Walls and vertical surfaces may be covered with continuously saturated burlap, or kept moist by other approved means. Horizontal surfaces, slabs, etc. shall be ponded to a depth of ½-inch wherever practicable, or kept continuously wet by the use of lawn sprinklers, a complete covering of continuously saturated burlap, or other approved means. Except on surfaces to which additional coatings or materials
are to be bonded, the Contractor may at his option use an approved membrane-curing compound in lieu of water curing concrete. The compound shall be similar and equal to Master Builders Company “Master Cure”. Shall be delivered to the job in the manufacturer’s containers, and shall be applied in strict accordance with the manufacturer’s printed instructions.

C. Curing compound for exposed surfaces shall be non-staining.

D. For at least seven (7) days after having been placed, all concrete shall be so protected that the temperature at the surface will not fall below fifty degrees F (50°F).

E. No manure, salt or other chemicals shall be used for protection.

F. The seven-day (7) curing period mentioned above may be reduced to three (3) days in each case if high-early-strength cement is used in the concrete.

G. Wherever practicable, finish slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

3.7 FINISHING - GENERAL

A. Unless otherwise noted, strike-off concrete surfaces to elevations and profiles indicated, and finish with wood or cork float or steel trowel as hereinafter specified, even and true, and free from cracks, pockets, or other imperfections. Discontinue as soon as water appears on surface. Finishes, except at warped surfaces, shall be such that irregularities shall not exceed 1 1/4-inch as measured by a ten-foot (10-foot) straightedge.

B. Following removal of forms, thoroughly wet all surfaces to remain exposed. Fill all honeycombs, tie rod holes and areas damaged in form removal with grout composed of one (1) part Portland cement to two (2) parts of sand, with water as required, and rub with abrasive stones to a smooth, uniform surface.

C. Any work not formed as indicated on the drawings, or that is not of alignment or level, or shows a defective surface shall be corrected in a manner satisfactory to the Engineer.

D. It is expected that forms, concrete and workmanship shall be such that the quantity of trimming and repair work is kept to a minimum. Defective concrete shall be cut normal to the surface until sound concrete is reached, but not less than one (1) inch deep; the remaining concrete shall be thoroughly roughened and cleaned.

E. All exposed concrete surfaces, except troweled surfaces and the interior surfaces of all concrete tanks, channels and conduits (both open and covered) that will contain or transmit water, sewage or sludge, shall be given a grout finish application. Exterior walls shall be so finished to a point twelve (12) inches below final grade. This operation shall not be undertaken until all the concrete work for the particular structural unit is completed and all mortar splatter and soils stains have been removed.

F. The grout finish shall be a one to one ratio (1:1) by volume cement-sand grout using sand passing the No. 16 sieve. The surface shall be cleaned, and thoroughly wet. The grout mixed to creamy consistency and shall be scrubbed into the surface with a stiff brush. Defective or loose concrete shall be removed and repaired to the satisfaction of the Engineer prior to grouting.
G. Unless otherwise specified, all surfaces not built against forms, such as surfaces of pit floors or tank bottoms and similar surfaces, shall be accurately screened to the required form, wood floated, and steel troweled to a hard even finish.

H. Unless otherwise directed, all edges and corners which will be exposed to the finished work shall be beveled or rounded by the use of appropriate forms or form inserts, and care shall be taken to prevent chipping or cracking of finished edges.

3.8 FLOOR FINISHES

A. Unformed surfaces shall be finished in accordance with ACI 302.

B. Wood float finish all stairs and stair landings. Steel trowel finish all other floors. If, after a suitable curing time, the Engineer determines that the concrete floor finish is not of acceptable quality, the Contractor shall apply an approved floor hardener, at no additional expense. Floor hardener shall not have a paraffin base.

C. Immediately following floating or troweling, and when surface has hardened sufficiently to prevent removal of fines and marking of surface, scrub surfaces to receive hardener with a non-saponifying detergent, rinse in clear water and allow to dry. Treat surface with three (3) applications of floor hardener in varying proportions and in the manner recommended by the manufacturer. Following drying of the third coat, spots showing incomplete treatment shall be given additional applications as required to produce a uniform surface.

3.9 EXTERIOR WALKWAYS AND PAVING

At exterior sidewalks, finish edges with standard radius tool and mark off false joints 1/2-inch deep, spaced at five-foot (5-foot) intervals. Sidewalks shall be broom-finished. Provide 1/4-inch expansion joints every third joint. Wood float curbs and gutters, and broom-finish concrete paving and exterior ramps and aprons.

END OF SECTION
SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SCOPE
The Contractor shall furnish and place all concrete reinforcement, as indicated on the drawings or herein specified.

1.2 DRAWINGS AND SCHEDULES
In a manner similar to the Shop Drawing submittal requirements of the General Conditions, the Contractor shall submit to the Engineer for approval, six (6) sets of cutting and bending drawings and schedules for all reinforcement. Reinforcing steel shall not be fabricated until Shop Drawings have been approved.

PART 2 - PRODUCT

2.1 GENERAL REQUIREMENTS
Concrete reinforcement in sizes No.3 (3/8-inch) and larger shall be deformed steel bars of the shapes and sizes indicated on the Drawings.

2.2 QUALITY
A. The steel shall be newly rolled stock, substantially free from mill scale, rust, dirt, grease or other foreign matter. Bars shall be domestic billet steel or rail steel.

B. Billet steel bars shall be intermediate (Grade 60) in conformance with ASTM A615.

C. Rail steel bars, if used, shall conform to ASTM A616.

D. In the case of rail steel bars, the bars shall be rerolled by an approved mill. The Contractor shall submit at his expense certified copies of tests of rail steel bars furnished. The tests shall be as specified in the appropriate ASTM specifications referred to above, and shall be made by an approved laboratory. To be accepted for use, the bars shall show an elongation in eight (8) inches of at least that required by the ASTM specifications, but no less than 10.5 percent.

E. Welded wire fabric (mesh) shall conform to ASTM A 185.

PART 3 - EXECUTION

3.1 FABRICATING REINFORCEMENT
A. Reinforcement shall be accurately formed to the dimensions indicated on the drawings and in accordance with ACI 315. Stirrups and tiebars shall be bent around a pin having a diameter not less than two (2) times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six (6) times the minimum thickness except for bars larger than one (1) inch in which case the bends shall be made around a pin of eight (8) bar diameters. All bars shall be bent cold.
B. Metal supports for reinforcing in concrete, which is to be exposed to the atmosphere, or to sewage or water flow shall be plastic coated or galvanized.

C. Bars shall be shipped to the job site with bars of the same size and shape fastened in bundles with metal identification tags giving size and mark securely wired on.

3.2 PLACING REINFORCEMENT

A. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust scale, dirt and other coatings including ice that will reduce or destroy bond. Where there is delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

B. Reinforcement shall be accurately positioned as indicated on the drawings, and secured against displacement by using annealed iron wire ties or suitable clips at intersections. Bar splices, laps, etc., shall be as called for on the drawings, or if not called for, laps shall be not less than forty (40) times the nominal diameter of the larger bar spliced. Wire mesh sheets shall have a side lap and end lap of not less than six (6) inches. Concrete blocks having a minimum bearing area of two (2) inches by two (2) inches and equal in quality to the concrete specified shall be used for supporting reinforcing bars in footings and slabs on grade. For other concrete work, metal supports, spacers, or hangers may be used. Wood blocks, stones, brick chips, etc., shall not be used to support reinforcement. Wire ties shall be cut back so that no metal is within one (1) inch of the surface when the concrete is exposed to view.

C. Reinforcement, which is to be exposed to the atmosphere for a considerable length of time after having been placed, shall be painted with a heavy coat of cement grout.

END OF SECTION
SECTION 09800

PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes the coating of all interior and exterior surfaces specified or shown.

1.2 REFERENCES

A. ASTM D16--Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D3359--Method for Measuring Adhesion by Tape Test.

C. NACE (National Association of Corrosion Engineers)--Industrial Maintenance Painting.


F. SSPC (Steel Structures Painting Council)--Steel Structures Painting Manual.

G. Paint manufacturer's printed instructions.

1.3 DEFINITIONS

A. dft - dry film thickness

B. mil(s) - a unit of measure equal to a thousandth of an inch (0.0254) mm.

C. VOC(s) - volatile organic compound(s)

1.4 INTERPRETATION

A. The Engineer's decision shall be final in the interpretation and/or conflict between any of the referenced Specifications and Standards contained herein.

1.5 SUBMITTALS

A. Information to be Provided: Provide a list of materials to be used under this Section. Submit the list before the materials are delivered to the job site. Cross reference the list to the coating systems identified. Furnish with the list, the coating manufacturer's standard product data and color chart for each material to be used.

B. Manufacturer’s color charts shall be submitted to the Engineer at least 30 days or prior to paint application. Coordinate work so as to allow sufficient time for paint to be delivered to the job site.
1.6 QUALITY ASSURANCE

A. General:

Use quality assurance procedures and practices to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards.

B. Surface Preparation:

Surface preparation will be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces" SSPC-VIS 1-89 and ASTM Designation D2200, "Standard Methods of Evaluating Degree of Rusting on Painted Steel Surfaces" SSPC-VIS 2 and ASTM Designation D610; "Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive".

C. Application:

No coating shall be applied: When the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein; or in rain, snow, fog or mist; when the temperature is less than 5 degrees F above the dew point; when the air temperature is expected to drop below 35 degrees F within six hours after application of coating. Dew point shall measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. If the above conditions are forecast, coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.

D. Thickness and Holiday Checking (Steel Surfaces):

Thickness of coatings shall be checked with a non-destructive, magnetic-type thickness gauge. Use as instrument such as a Tooke Gauge if a destructive tester is deemed necessary. The integrity of coated surfaces shall be checked with an approved inspection device. Non-destructive holidays shall not exceed 67½ volts nor shall destructive holiday detectors exceed the voltage recommended by the manufacturer of the coating system. For thickness between 10 and 20 mils, use a non-sudsing type wetting agent, such as Kodak Photo-Flow. Failures shall be marked, repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

E. Inspection Devices:

The contractor shall furnish, until final acceptance of coating and painting, inspection devices in good working condition for detection of holidays and measurement of dry film thickness (dft) of coating. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dft gauges and certified instrumentation to test accuracy of holiday detector. Dry film thickness gauges and holiday detectors shall be made available for the Engineer's use at all times until final acceptance of application. Holiday detection devices shall be operated in the presence of the Engineer.
F. Warranty Inspection:

Warranty inspection shall be conducted during the eleventh month following completion of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Engineer/Owner.

1.7 QUALIFICATIONS

A. The Contractor shall have three years practical experience and successful history in the application of specified products to surfaces in water treatment, wastewater treatment, or industrial facilities. The Contractor shall be a knowledgeable and experienced professional, fully aware of the methods and regulatory requirements of coating removal and application.

Upon request, he shall substantiate this requirement by furnishing a list of references and job completions.

1.8 SAFETY AND HEALTH REQUIREMENTS:

A. General: The Contractor shall perform all work in accordance with applicable local, state, and federal laws and regulations, and material manufacturer's instructions and recommendations pertaining to the methods, materials, or activities in the work. Some of these regulations are included in the following groups:

1. Occupational Safety and Health Act and derived regulations.
2. Clean Air Act and derived regulations, both federal and state.

B. The items listed below in the rest of this Paragraph are intended to call the Contractor's attention to some of the frequently necessary compliance activities. The Contractor is solely responsible for compliance with applicable regulations including, but not limited to, the areas identified in this Specification. The Contractor shall provide and require the use of personal protective equipment for persons working on or about the project.

1. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear appropriate eye and face protection devices and air purifying, half mask or mouthpiece respirators with appropriate filters.

2. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminants to the degree a hazard does not exist. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

3. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.

4. Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the Engineer, the Contractor shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the Engineer.
5. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall confirm to applicable safety requirements. They shall be erected where requested by the Engineer to facilitate inspection and be moved by the Contractor to locations requested by the Engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Materials specified are those that have been evaluated for the specific service. Products are listed to establish a standard of quality. Equivalent materials of other manufacturers may be substituted on written approval of the Engineer in accordance with Section 01330.

Requests for substitution shall include manufacturer's literature for each product giving name, product number, generic type, descriptive information, solids by volume, recommended dft and certified laboratory test reports showing results to equal the performance criteria of the products specified herein. In addition, a list of five projects shall be submitted in which each product has been used and rendered satisfactory service. The listed projects shall be in the States of Texas, Oklahoma, Louisiana, or Arkansas.

2.2 DELIVERY AND STORAGE

A. All materials shall be brought to jobsite in original sealed containers. They shall not be used until the Engineer has inspected contents and obtained data from information on containers or label. Materials exceeding storage life recommended by the manufacturer shall be rejected.

B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings or paint must be stored to conform with City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

2.3 MATERIALS

A. The number of coats called for in this schedule shall be considered minimum. If additional coats are required for complete coverage and uniform appearance, they shall be applied. Pipeline and associated equipment colors will be the standard for the type of service being painted (Refer to Table 1 below). The Owner reserves the right to select colors for buildings and large equipment from a color chart provided by the contractor. The system numbering may not be sequential or inclusive of all numbers from the first to last system or schedule numbers.
SYSTEM NO. 1

TYPE OF SURFACE: Metal (excluding stainless steel, aluminum and galvanized steel)

TYPE OF STRUCTURE: Treatment plant area components such as, but not limited to: valves, pipes, pumps, blowers, equipment, doors, door frames, metal trim, trusses, miscellaneous steel.

EXPOSURE CONDITION: Non-Submerged; inside or outside

SURFACE PREPARATION: Surface shall be sandblasted to a SSPC-SP6 commercial finish. Surface shall be dry and free of all rust and old paint.

PAINTING SYSTEM:

FIRST COAT: Tnemec Series 66-1211 H.B. 3.0 dft mils

EP OXOLINE PRIMER

SECOND COAT: Tnemec Series 66 Color 5.0 dft mils

H.B. EPOXOLINE

THIRD COAT (INTERIOR): Tnemec Series 66 Color 5.0 dft mils

H.B. EPOXOLINE

THIRD COAT (EXTERIOR): Tnemec Series 74 Color 4.0 dft mils

ENDER SA SHIELD IV

TOTAL THICKNESS Tnemec Series = 12.5 dft mils min.

OR

ALTERNATE FIRST COAT: Sherwin-Williams Epoxide 52 3.0 - 4.0 dft mils

B67R500/B67V500

ALTERNATE SECOND COAT: Sherwin-Williams Macropoxy HS 4.0 - 6.0 dft mils

B58-400/B58V400

ALTERNATE THIRD COAT (INTERIOR): Sherwin-Williams Macropoxy HS 4.0 - 6.0 dft mils

B58-400/B58V400

ALTERNATE THIRD COAT (EXTERIOR): Sherwin-Williams Hi-Solids Polyurethane 3.0 - 4.0 dft mils

B65-300/B60V30

TOTAL THICKNESS Sherwin-Williams = 12.5 MILS DFT MIN.
SYSTEM NO. 2

TYPE OF SURFACE: Metal (excluding stainless steel, aluminum and galvanized steel).

TYPE OF STRUCTURE: Treatment plant area components such as, but not limited to: valves, pipes, pumps, equipment and miscellaneous steel.

EXPOSURE CONDITION: Submerged or splashed.

SURFACE PREPARATION: SSPC-SP10 Near-white blast.

PAINTING SYSTEM:

FIRST COAT: Tnemec Series 104-1255 Beige 6.0 - 8.0 DFT MILS
Pota-Pox Plus

SECOND COAT: Tnemec Series 140-AA83 Tank White 6.0 - 8.0 DFT MILS
Pota-Pox Plus
Total Thickness Tnemec Series = 14.0 DFT MILS MIN.

OR

ALTERNATE FIRST COAT: Sherwin-Williams Tank Clad HS 6.0 - 8.0 DFT MILS
B62 Series/B60V80

ALTERNATE SECOND COAT: Sherwin-Williams Tank Clad HS 6.0 - 8.0 DFT MILS
B62 Series/B60V80
Total Thickness Sherwin-Williams = 14.0 MILS DFT MIN.
SYSTEM NO. 3

TYPE OF SURFACE: Galvanized Steel
TYPE OF STRUCTURE: Throughout plant, galvanized steel repair
EXPOSURE CONDITION: Atmospheric
SURFACE PREPARATION: SSPC-SP6: Commercial Blast Cleaning. Surface must be clean and dry.

PAINTING SYSTEM:

First Coat: Tnemec Series 90-97 Tnemic-Zinc 3.0 – 3.5 DFT MILS

OR

Alternate First Coat: Sherwin-Williams Corothane I Zinc Primer 3.0 - 4.0 DFT MILS

B65A14/B69D210

3.1 GENERAL

A. All surface preparation, coating and painting shall conform to applicable standards of the Steel Structures Painting Council and the manufacturer's printed instructions. Material applied to the surface prior to the approval of the Engineer shall be removed and re-applied to the satisfaction of the Engineer at the expense of the Contractor.

B. All work shall be performed by skilled craftsmen qualified to perform the Required work in a manner comparable with the best standards of practice. Continuity of personnel shall be coordinated with the Engineer.

C. The Contractor shall provide a supervisor at the work site during cleaning and application operations. The supervisor shall have the authority to sign change orders, coordinate work and make decisions pertaining to the fulfillment of the contract.

D. Dust, dirt, oil, grease or any foreign matter that will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags.

E. Coating and painting systems include surface preparation, prime coating and finish coatings. Unless otherwise approved by the Engineer, prime coating shall be field applied. Where prime coatings are shop applied, the Contractor shall instruct suppliers to provide the prime coat compatible with the finish coat specified. Any off-site work that does not conform to this specification that is damaged during transportation, construction or installation shall be thoroughly cleaned and touched-up in the field as directed by the Engineer. The Contractor shall use repair procedures that insure the complete protection of all adjacent primer. The specified repair method and equipment may include wire brushing, hand or power tool cleaning, or dry-air blast cleaning. In order to prevent injury to surrounding painted areas, blast cleaning may require use of lower air pressure, smaller nozzle and abrasive particle sizes, or shorter blast nozzle distance from surface shielding and masking. If damage is too extensive or uneconomical to touch-up, then the item shall be re-cleaned and coated as directed by the Engineer.
F. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air.

G. Application of the first coat shall follow immediately after surface preparation and cleaning and before rust bloom occurs. Any cleaned areas not receiving first coat within this period shall be recleaned prior to application of first coat.

H. Prior to assembly, all surfaces made inaccessible after assembly shall be prepared as specified herein and shall receive the coating or paint system specified.

3.2 SURFACE PREPARATION

A. The latest revision of the following surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

1. **Solvent Cleaning (SSPC-SP1):** Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods which involve a solvent or cleaning action.

2. **Hand Tool Cleaning (SSPC-SP2):** Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by hand chipping, scraping, sanding and wire brushing.

3. **Power Tool Cleaning (SSPC-SP3):** Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by power wire brushing, power impact tools or power sanders.

4. **White Metal Blast Cleaning (SSPC-SP5):** Blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.

5. **Commercial Blast Cleaning (SSPC-SP6):** Blast cleaning until at least two-thirds of each element of surface area is free of all visible residues.

6. **Brush-Off Blast Cleaning (SSPC-SP7):** Blast cleaning to remove loose rust, loose mil scale and other detrimental foreign matter to degree specified.

7. **Near White Blast Cleaning (SSPC-SP10):** The removal of all visible oil, grease, dirt, dust, mil scale, rust, paint, oxides, corrosion products and other foreign matter by compressed air nozzle blasting, centrifugal wheels or other specific method. Discoloration caused by certain stains shall be limited to no more than 5% of each square inch of surface area.

8. **Power Tool Cleaning to Bare Metal (SSPC-SP11):** The removal of all visible oil, grease, dirt, mil scale, rust, paint, oxide, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. Differs from SSPC-SP3 in that it requires more thorough cleaning and a surface profile not less than 1 mil (25 microns). For areas where abrasive blasting is prohibited or not feasible.

B. Slag and weld metal accumulation and spatters not removed by the Fabricator, Erector or Installer shall be removed by chipping and grinding. All sharp edges shall be penned, ground or otherwise blunted as required by the Engineer.
C. Field blast cleaning for all surfaces shall be by dry method unless otherwise directed.

D. Particle size of abrasive used in blast cleaning shall be that which will produce a 1.5-2.0 mils (37.5 microns-50.0 microns) surface profile or in accordance with recommendations of the manufacturer of the specified coating or paint system to be applied.

E. Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused unless specifically approved by the Engineer.

F. During blast cleaning operations, caution shall be exercised to insure that existing coatings or paint are not exposed to abrasion from blast cleaning.

G. The Contractor shall keep the area of his work and the surrounding environment in a clean condition. He shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the accomplishment of the work, the operation of the existing facilities, or nuisance to the surrounding environment.

H. Blast cleaned surfaces shall be cleaned prior to application of specified coatings or paint. No coatings or paint shall be applied over damp or moist surfaces.

I. All welds shall be neutralized with a suitable chemical compatible with the specified coating materials.

J. Specific Surface Preparation: Surface preparation for the specific system shall be as noted in Section 2.1.

3.3 APPLICATION

A. Coating and paint application shall conform to the requirements of the Steel Structures Painting Council Paint Application Specification SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting", the American Water Works Association and the manufacturer of the coating and paint materials.

B. Thinning shall be permitted only as recommended by the manufacturer approved by the Engineer, and utilizing the thinners stated in Section 2.2 Paragraphs D and E.

C. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

D. Protective coverings or drop cloths shall be used to protect floors, textures, and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces which are not to be coated or painted. Report surfaces from which materials cannot be satisfactorily removed to the Engineer.

E. When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additive to act as an indicator of coverage or the two coats must be of contrasting color.
F. Film thicknesses per coat specified in Section 2.2 are minimum required. If roller application is deemed necessary, the Contractor shall apply additional coats to achieve the specified thickness.

G. All material shall be applied as specified.

H. All welds and irregular surfaces shall receive a brush coat of the specific product prior to application of the first complete coat.

3.4 COATING SYSTEM APPLICATION:

A. After completion of surface preparation as specified for the specific system, materials shall be applied as noted in Section 2.2.

3.5 COLOR SCHEME

A. The Engineer shall select colors for the project. The Contractor shall submit a current chart of the manufacturer's available colors to the Engineer thirty days prior to the start of coating and painting.

B. Similar equipment/structures to those used in the original plant construction shall be painted to match the existing equipment/structures.

3.6 DISINFECTION

A. Disinfection may be required for interior surfaces of tanks or systems containing potable water. Coordinate painting with disinfection requirements.

3.7 VAPOR REMOVAL

A. All solvent vapors shall be completely removed by suction-type exhaust fans and blowers before placing tank or system in operating service.

3.8 CLEANING

A. Upon completion of the work, all staging, scaffolding and containers, waste blast abrasive, or other painting debris shall be removed from the site. Coating or paint spots or oil stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired, or refinished to the satisfaction of the Engineer at no cost to the Owner.

3.9 EXTERIOR COATING SCHEDULE

A. Coating systems shall be as scheduled below. The schedule is not all inclusive; new construction and items noted on the Drawings shall be coated by the Contractor with the appropriate system specified herein.

1. Galvanized metals are not to be recoated, except for repair of coating damaged during construction.

2. Stainless steel and aluminum are not scheduled for coating.

3. Refer to Section 07176 for coating requirements of exterior CMU.
B. Schedule

1. Piping/Valves/Motors - Submerged  
   - Non-submerged  
   System 2  
   System 1

2. Steel (all exposed metals, including: joists; doors; bollards; and miscellaneous metals).  
   System 1

3. Galvanizing repair (fabricated steel, hot-dipped; Other galvanized items)  
   System 3

Table 1 - Pipeline Color Coding:

<table>
<thead>
<tr>
<th>Type of Line</th>
<th>Contents of Line</th>
<th>Color of Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Lines</td>
<td>Non potable water</td>
<td>Blue w/black stripes</td>
</tr>
<tr>
<td></td>
<td>Finished or potable water</td>
<td>Dark Blue</td>
</tr>
<tr>
<td>Chemical Lines</td>
<td>Alum or primary coagulant</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>Chlorine gas or solution</td>
<td>Yellow</td>
</tr>
<tr>
<td></td>
<td>Phosphate compounds</td>
<td>Light green w/red band</td>
</tr>
<tr>
<td></td>
<td>Polymers or coagulants</td>
<td>Light green w/orange band</td>
</tr>
<tr>
<td>Sewage (Wastewater)</td>
<td>Sewage</td>
<td>Gray</td>
</tr>
<tr>
<td>Sludge Lines</td>
<td>Sludge draw off</td>
<td>Brown w/orange bands</td>
</tr>
<tr>
<td></td>
<td>Sludge recirculation discharge</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Raw sludge</td>
<td>Brown w/black bands</td>
</tr>
<tr>
<td></td>
<td>Sludge recirculation or suction</td>
<td>Brown w/yellow bands</td>
</tr>
<tr>
<td>Compressed Air Lines</td>
<td>Air</td>
<td>Dark Green</td>
</tr>
<tr>
<td>Gas Lines</td>
<td>Natural gas or propane</td>
<td>Red w/black bands</td>
</tr>
<tr>
<td>Reuse</td>
<td>WWTP Treated effluent</td>
<td>Purple</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 11000

PACKAGED WASTEWATER TREATMENT PLANT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, equipment, materials, and incidentals as required to furnish, install, check, calibrate, start-up, test, document, and place in satisfactory operation, the 0.050 MGD average daily flow packaged activated sludge wastewater treatment plant (Packaged WWTP) complete with all appurtenances for proper operation as shown and as specified.

2. Packaged WWTP shall be of the Modified Ludzak-Ettinger (MLE) configuration.

3. Items furnished under this Section shall include, but not be limited to the following:

a. Concrete packaged treatment plant.

b. Air distribution system including blowers, coarse bubble diffusers, air piping and valves, and other ancillary components.

c. Aerated flow equalization basin including influent manual bar screen, flow equalization, valves, level floats, and other ancillary equipment.

d. Anoxic chamber(s) with mechanical mixing equipment.

e. Aeration basin(s).

f. Two hydraulically separated clarifier with RAS/WAS airlift pumps, inlet baffle, effluent baffle, air driven skimmer system, effluent weir and other ancillary components.

g. Chlorine contact chamber including chlorine tablet feed system, baffles, and other ancillary components.

h. Aerated sludge holding chamber including air driven supernatant return system.

i. Access stairway and walkway grating.

j. Flanged influent and effluent piping connections and internal piping and valves.

k. Control panels.

l. Electrical and instrumentation components specified herein.

m. Painting.

n. Spare parts as specified.
4. The Packaged WWTP shall be provided by a SINGLE manufacturer with sole responsibility for the satisfactory manufacture, delivery, start-up, performance testing, and training for the complete furnished Packaged WWTP.

5. Unless stated otherwise, the term Manufacturer stated herein shall refer to the manufacturer responsible for the supply of the Packaged WWTP.

B. General:

1. Naming of a manufacturer does not indicate approval nor shall standard product offerings by any manufacturers be accepted in lieu of component features as specified herein. All manufacturers are required to comply fully with these specifications.

2. Descriptions contained hereinafter are for guidance and to show the functions desired. They do not describe or specify all components to interface equipment. All parts and equipment necessary to meet functional and performance requirements shall be provided and fit within the dimensions and configuration shown.

3. The site, mechanical, structural, instrumentation, and electrical design has been based on a Packaged WWTP manufactured by Macke Industries, Inc. Brunswick, Ohio. The cost of any changes or modifications to site, mechanical, structural, instrumentation, or electrical facilities necessary to adapt alternate equipment to the layout and design shown shall be borne solely by CONTRACTOR. Any such proposed changes or modifications are subject to review and acceptance by the ENGINEER in accordance with the special instructions in Instructions to Bidders. Clearances shown shall be maintained.

4. CONTRACTOR shall be completely responsible for the proper operation and function of the Packaged WWTP herein specified. CONTRACTOR shall be responsible for coordination of all mechanical, structural, instrumentation, or electrical facilities to achieve the required Packaged WWTP operation and treatment performance.

5. Some equipment may require modifications from the Manufacturer's standard to conform to the Contract Documents.

6. All fasteners (nuts, bolts and washers) used for Packaged WWTP shall be Type 316 stainless steel.

7. Blowers, mixers, and specified control panels shall be supplied as part of the Packaged WWTP.

8. Control panels for the Packaged WWTP equipment shall be provided as shown in Design Drawings.

9. Wiring, motor starters, and other electrical equipment and materials are as specified in Design Drawings.

10. All components of the Packaged WWTP shall be factory coated, unless otherwise specified. Provisions for field touch up shall be made.

C. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the Packaged WWTP Work.
D. Related Sections:

1. Section 03100 Concrete.
2. Section 09800 Painting.
3. Section 15051 Buried Piping Installation.
4. Section 15062 Interior and Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. Anti-Friction Bearing Manufacturers' Association, (AFBMA).

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: a. Minimum of five years of experience producing substantially similar equipment and able to show evidence of at least five installations in satisfactory operation for at least five years, Florida references are preferred. Provide at least five references: name, address, phone, and email.

2. Professional Engineer:
   a. Engage a registered professional engineer legally qualified to practice in the State of Florida and experienced in providing engineering services of the kind indicated.
   b. Submit qualifications data.
   c. Responsibilities include but are not necessarily limited to:
      1) Carefully reviewing performance and design criteria stated in the Contract Documents.
      2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
      3) Preparing or supervising the preparation of design calculations and related drawings, Shop Drawings, operations manuals, and a comprehensive engineering analysis verifying compliance of the with the requirements of the Contract Documents.
4) Signing and sealing all calculations and design drawings, and Shop Drawings.

5) Certifying that:
   a) It has confirmed the design of the plant in accordance with the performance and design criteria stated in the Contract Documents, and
   b) The said design conforms to all applicable local, state and federal codes, rules and regulations, and to the prevailing standards of practice.

B. Requirements of Regulatory Agencies: Comply with the applicable provisions of the Florida Department of Environmental Protection and the current edition of the Florida Building Code.

C. Products used in the Work of this Section shall be produced by manufacturers regularly engaged in the production of such items and have a successful history of product acceptability, as interpreted by ENGINEER.

D. Responsibilities:
   1. In order to centralize responsibility, it is required that all equipment provided as part of the Packaged WWTP be obtained from a single supplier or manufacturer who shall assume full responsibility for the completeness of the system. The supplier or manufacturer shall be the source of information on all equipment furnished regardless of the manufacturing source of that equipment.
   2. The sole responsibility for proper operation of the Packaged WWTP shall rest with CONTRACTOR.

E. CONTRACTOR shall provide certifications that all stainless-steel accessories, including hangers and supports, are Type 316 stainless steel.

1.4 SUBMITTALS

A. Action Submittals:

Submit the following:

1. Shop Drawings:
   a. CONTRACTOR shall submit for review to ENGINEER, sufficient literature, detailed specifications, and drawings to show dimensions, fabricator or manufacturer, speed, model, size, type, horsepower, service factors, efficiency, materials used, design features, internal construction, weights, and any other information required by ENGINEER for review of all Packaged WWTP equipment. Packaged WWTP equipment will be accepted, and installation will not be allowed until such review has been completed.
   b. Shop Drawings shall include, as a minimum, the following:
      1) Dimensions of Packaged WWTP, including compartments, internal and external equipment, pipe, fittings, connection points, access systems, electrical and instrumentation components, and other appurtenances.
      2) Materials of construction of all system components.
      3) Service Conditions: Chemical environment and temperature.
4) Statement that construction shall be in accordance with these Specifications.

5) Description of construction.

7) Complete, detailed instructions on the installation of the Packaged WWTP, equipment, and piping.

8) Diffuser system and piping layout including supports.

9) Detailed information on instrumentation components including manufacturer model, materials of construction, and location.

10) Dimensions and locations of access stairway and walkway grating.

11) Full drain outlet details.

12) Submit a list of five similar installations, with contacts, currently operating a similar Packaged WWTP.

13) Wiring diagrams for all equipment as required.

14) Control panel submittal as shown in Design Drawings.

15) Detailed process calculations that are signed and sealed by a Professional Engineer, including but not limited to:
   a) Hydraulic Retention Time.
   b) Basin Volumes.
   c) Standard oxygen transfer efficiency (SOTE) of the aeration system.
   d) List of parameters used in basin sizing.
   e) Expected treatment efficiencies.

c. Submittal for disinfection system shall include as a minimum the following:
   1) Manufacturer's capacity data.
   2) Shop Drawings providing details of construction, dimensions, and connection locations.
   3) Descriptive literature, bulletins, and catalogs of the equipment.
   4) A complete bill of materials.
   5) A list of the manufacturer's recommended spare parts.

d. Submittal for the flow equalization and mixed liquor recycle pumps shall include as a minimum the following:
   1) Manufacturers rating data and pump curves.
   2) Shop Drawings providing details of construction, dimensions, and connection locations.
   3) Descriptive literature, bulletins, and catalogs of equipment.
4) A complete bill of materials.

5) A list of manufacturer’s recommended spare parts; including gaskets, packing, etc.

6) Complete data on motors, motor starters, nameplate data, controls, and motor control schematic wiring diagrams.

e. Detailed structural calculations that are signed and sealed by a Structural Engineer, registered in the State of Florida, including but not limited to:

1) Stairs
2) Walkway
3) Railing
4) Anchor System

f. Submittal for the blowers shall include as a minimum the following:

1) Manufacturer's rating data.

2) Shop Drawings providing materials and details of construction, dimensions, and anchor bolt locations.

3) Descriptive literature, performance curves, bulletins, and catalogs of the equipment.

4) The total weight of the equipment.

5) A complete bill of materials.

6) A list of the manufacturer's recommended spare parts.

7) Complete data on motors, motor starters, nameplate data, controls, and motor control schematic wiring diagrams.

8) Data on noise in accordance with AMCA 300.

9) Description of surface preparation and shop primer and shop finish coating as specified in this Section.

10) Results of factory dynamic balance of blower and field check of dynamic balance of blower.

g. Submittal for the mixers shall include as a minimum the following:

1) Manufacturer's rating data.

2) Shop Drawings providing materials and details of construction, dimensions, and connection locations.

3) Descriptive literature, bulletins, and catalogs of the equipment.

4) The total weight of the equipment.

5) A complete bill of materials.

6) A list of the manufacturer's recommended spare parts.
7) Complete data on motors, motor starters, nameplate data, controls, and motor control schematic wiring diagrams.

h. Expansion joints and flexible connectors for blowers, pumps, and piping.

i. Flow meters and level floats.

j. Material list.

2. Performance Testing Plans and Procedures:

a. Submit written test procedures for the required Packaged WWTP startup and performance testing.

b. At a minimum the performance tests must demonstrate the system’s ability to meet the design criteria set forth in this Section.

B. Informational Submittals: Submit the following:

1. Test and Evaluation Reports:

   a. UL Label.

2. Site Quality Control Submittals:

   a. Test Results: Submit a written report providing the results of the required start up and performance tests.

3. Supplier Reports:

   a. Submit a written report of the results of each visit by a Manufacturer's serviceman, including purpose and time of visit, tasks performed and results obtained.

C. Closeout Submittals: Submit the following:

1. Operation and Maintenance Manuals:

   a. Submit complete installation, operation and maintenance manuals, test reports, maintenance data and schedules, description of operation, and spare parts information.

   b. Packaged WWTP Manufacturer shall provide detailed plant and equipment operating and maintenance instructions. Each O&M manual shall be prepared specifically for the type of equipment delivered, and all instructions shall refer only to that particular equipment.

   c. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

   d. There shall be a minimum of two volumes of Operations and Maintenance Manuals.

   e. Volume I shall detail the care and operation of the treatment plant. It shall provide instructions on normal, hot and cold weather, emergency, and troubleshooting operations for each unit. It shall provide the operator with “best practices” for various operating conditions. It shall also include guidelines on health and safety. This information shall be discussed in detail during training. Volume II shall consist of a
D. Maintenance Materials Submittals:

Submit the following:

1. Spare Parts:
   a. Furnish all required spare parts as specified in Part 2 of this specification.

2. Tools:
   a. Furnish all required special tools as specified in Part 2 of this specification.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Product Delivery, Storage and Handling:

1. CONTRACTOR shall be responsible for safe transportation, including all freight costs for delivery to the Site, procuring any required permits, handling, and open air storage of the Packaged WWTP and other materials purchased as specified in this Section.

2. All equipment shall be properly protected such that no damage will occur from the time of shipment until the time of installation.

3. Manufacturer shall protect all flange faces and the more fragile appurtenances of the sub-assemblies, with padding between pieces in order to prevent one piece from impacting with another, and by crating or other means for shipment.

4. CONTRACTOR shall be responsible for offloading all shipped equipment and shall inspect all equipment upon arrival. CONTRACTOR shall notify the Manufacturer within 24 hours of any damage to equipment or surface finish due to shipping.

5. Packaged WWTP and ancillary equipment shall be unloaded with care at their final destination where they will be free from damage. Manufacturer shall supply detailed storage instructions at the time of shipment.

6. Large sub-assemblies shall be supported during unloading to prevent excessive deflection and overstressing.

7. Pumps shall come completely assembled and protected against entry of foreign objects. Suction and discharge ports shall be protected against entry of foreign objects.

8. Store equipment and materials so as to keep free from moisture, damage, deterioration, and theft.

9. Structure and equipment shall be protected, by padding or bracing, from banding or ropes used in shipment. No chains are to be used to secure any equipment in transportation.
1.6 EQUIPMENT INSPECTIONS

A. Prior to final inspection, all surfaces shall be made clean by brushing, wiping, or with a compressed-air blast to remove all loose foreign materials.

B. A thorough inspection of each piece of equipment will be conducted upon arrival at the Site to inspect for damage incurred in transit. Any damage shall be immediately repaired by respective equipment fabricator's personnel, not a sales representative.

1.7 GENERAL REQUIREMENTS

A. The Drawings show general arrangement and extent of the Work to be completed, but the exact location and arrangement of all parts shall be determined as the Work progresses, to conform in the best possible manner with the actual Packaged WWTP supplied, and with the surroundings. The exact location of all parts of the Work must be governed by actual equipment supplied and Site conditions. Piping, equipment, ducts, etc. found to interfere with the construction of the equipment pad, plumbing apparatus and piping, panel, electrical wiring or other obstructions, etc. shall be located to clear such obstructions. Connections shown to the various units are intended as an indication only. The actual connections shall be made and to best suit each particular case, provide for expansion, clearances, vibration, and minimize the amount of space required. Field adjustments are expected and shall not result in a request for change order by the CONTRACTOR.

B. Drawings do not show all offsets, fittings, accessories and details, which may be required. CONTRACTOR shall examine all the Contract Documents for conditions, which may affect the installation of the Work, and shall arrange the Work accordingly. Provide all required items to complete the systems to the extent required by the Contract Documents.

C. If piping can be run to better advantage, CONTRACTOR, before proceeding with the Work, shall prepare and submit complete Shop Drawings showing all details of the proposed rearrangement for written approval by the ENGINEER.

1.8 EQUIPMENT DEFECTS

A. Equipment that has mechanical defects and does not meet Manufacturer's requirements will be rejected and shall be replaced at CONTRACTOR'S full expense for furnishing, installing, removal, and replacement.

B. Mechanical defects shall include excessive vibration, improper balancing of rotating parts, improper tolerances, binding, excessive bearing heating, defective materials, improper fitting of parts, and any other defect which will in time damage the equipment or impair its operation.

C. Requirements shall be met concerning minimum and maximum dimensions and the specifications for materials. If it is found upon delivery that materials do not agree with the requirements of these Specifications as to size, type, quality, or metallurgy, they will be rejected as unfit for use in the Work.

1.9 WARRANTY

A. The Packaged WWTP Manufacturer shall warrant that the equipment supplied as part of the Packaged WWTP meets the requirements of the Contract Documents and that it is new and unused, free from defects in materials and/or workmanship. This warranty shall be for 18
months from equipment delivery to the job site or 12 months from system start-up, whichever comes first. In the event that it is determined that a defect exists, the manufacturer shall repair or replace the defective components, provided that any such defect was not the result of misuse of the component by the owner.

B. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the equipment manufacturer shall not be accepted. The CONTRACTOR, through agreements with the Packaged WWTP Manufacturer, shall be solely responsible for the warranty of the equipment and all related components.

C. This warranty shall be valid only if the product is properly serviced and operated under normal conditions and in accordance with the Manufacturer’s instructions.

PART 2 – PRODUCTS

2.1 GENERAL

A. When two or more units of equipment for the same purpose are required they shall be the product of one manufacturer.

B. Packaged WWTP Manufacturer: Provide a complete system furnished by one of the following: Mack Industries, Brunswick, Ohio, or approved equal.

2.2 DESIGN REQUIREMENTS

Packaged WWTP Design Criteria:

A. All components supplied shall conform to the size requirements as set forth in the plans, to the requirements included in other sections of this specification, and to the following broad design parameters.

B. Requirements per unit:

   Number of Packaged WWTPs-1

   Flow: Average daily design flow (gpd) 50,000

   Influent Characteristics:
   - CBOD5 (mg/L) 200
   - TSS (mg/L) 262
   - TKN (mg N/L) 75

   Maximum Effluent Requirements:
   - CBOD5 (mg/L) 20
   - TSS (mg/L) 20
   - TN (mg/L) 12
   - Alkalinity (as CaCO3) (mg/L) 55
   - Fecal Coliform 200 colonies/100ml
C. Process Volume Criteria:

Each process shall have 1.5 feet of free board.
Process 50,000 gpd ADF
Volume (gallons)
Flow Equalization Chamber 12,800
Anoxic Chamber 6,704
Post Anoxic Basin 11,000
Aeration Chamber 25,070
Clarifiers 12,500
Sludge Holding Chamber 16,042
Chlorine Contact Chamber 1,563 gal.

All volumes are minimums; minor variations may be allowed upon approval by the ENGINEER as long as system performance can be maintained.

2.3 EQUIPMENT

A. General:

1. Provisions shall be made for draining each compartment of the Packaged WWTP independently. All drains shall include a plug valve/SS ball valve, Camlock fittings, and water-tight cover. Camlock fittings and cover tube shall be 3/16 stainless steel.

B. Packaged WWTP Influent Connection:

1. Provide an influent connection to the Packaged WWTP consisting of one 4-inch flanged inlet entering the flow equalization chamber. The influent flow shall be discharged into a bar screen box with integral overflow weir.

C. Flow Equalization Chamber:

1. To control the peak hourly flow rates a flow equalization system shall be provided at the influent end of the Packaged WWTP. The influent peak flow rates shall enter into the flow equalization chamber where it is to be held and mixed until the secondary treatment system is ready to process it.

2. Influent flow shall enter the flow equalization chamber by passing through a manual bar screen flow-proportioning box. An adjustable side weir shall limit the maximum flow into the packaged WWTP.

3. The flow equalization chamber shall be covered with removable solid aluminum panels.

4. Manufacturer shall provide the following equipment:

   a. Two (2) flow equalization blower units. Refer to Air Distribution System in this Section for blower requirements.

   b. One (1) lot of coarse air diffusers with drop assemblies for mixing. Refer to Air Distribution System in this Section for requirements. The diffusers shall be capable of providing complete mixing of the chamber if it is half full or greater.

   c. Two (2) flow equalization pumps with a maximum capacity of 60 gpm. Pump shall be capable to flow raw water from the flow equalization chamber to the flow proportioning box. Pump shall be of the Gould submersible type, or approved equal,
rated for ½ HP, 460 volt, 3 phase, 60 Hz. The pumps shall operate in an alternated duty/stand-by configuration and shall be located in the flow equalization chamber, as shown. The motors shall be rated for continuous duty under full nameplate load while at full submergence. Each pump shall include a seal fail sensor. Pump guide rails shall be constructed of Type 316 stainless steel, and discharge piping shall be constructed of Schedule 80 PVC.

d. One (1) 316 stainless steel manual bar screen to remove large solids from the influent flow. The bar screen shall be fabricated from 1/2-inch diameter bars spaced 1/2-inch apart. The bars shall be sloped to permit easy removal of accumulated debris. A large screenings drying area with grating shall be provided, which allows excess water to drain to the equalization chamber.

e. One (1) flow proportioning box shall be provided, constructed of aluminum. The flow rate through the flow-proportioning box shall be controlled by an adjustable v-notch and flat overflow weir system.

f. Liquid level control sensors: level switch, float type as specified in Section 40 60 05, Instrumentation and Control for Process Systems.

g. Flow Equalization Local Control Panel (FE-LCP). See P&IDs for required switches, indicator lights, controllers, etc. Provisions shall be made to FE-LCP for connection with two remote HOA switches (provided by others) as shown in the drawings. The panel shall be shipped loose for installation in the field. Refer to the Electrical and Controls section, below and Section 40 60 05, Instrumentation and Control for Process Systems.

h. An emergency overflow weir shall allow the transfer of peak flows from the equalization chamber to the anoxic chambers to prevent overflows.

D. Anoxic Chamber(s):

1. The anoxic chamber(s) shall be designed to meet the requirements set forth in the Design Requirements paragraph of this Section. An anoxic chamber shall be provided to reduce nitrate to nitrogen gas to meet the nitrate effluent requirement. The total chamber volume can be provided with one or two chambers. The anoxic chamber(s) shall be covered with removable solid aluminum panels.

2. The anoxic chamber(s) shall be equipped with two fixed-mount, open tank, slow mixers, Lightnin Model Mi5Q1 or equal. Each mixer shall be rated for 1/2 hp, 460 volt, 3 phase, 60 Hz service, and shall be provided with TEFC motors designed for continuous operation. The mixers shall continuously mix the contents of the anoxic chamber(s) so as to prevent settling. The Packaged WWTP Manufacturer shall provide motors, housings, propellers, control panel as described below, anchorage systems, and all appurtenances required. The mixer shaft and blade shall be constructed of 316 stainless steel. Supports and anchor systems shall be constructed of 316 stainless steel. Both mixers shall provide complete mixing of chamber(s) and maintain mixed liquor and perform bottom scour.

3. The system shall be provided with an Anoxic Mixer Local Control Panel (AMLCP). See P&IDs for required switches, indicator lights, controllers, etc. Provisions shall be made to AMLCP for connection with two remote HOA switches (provided by others) and two remote E-stops (provided by others) as shown in the drawings. The panel shall be shipped
loose for installation in the field. Refer to the Electrical and Controls section, below and Section 40 60 05, Instrumentation and Control for Process Systems.

4. Units shall be capable of keeping solids in suspension and mixing municipal wastewater. Each mixer shall be capable of continuous operation with the mixer blade both partially or completely submerged and capable of continuous operation for a minimum of two hours unsubmerged. Mixer shall be able to be raised and lowered and shall be easily removed for inspection or service without the need for personnel to enter the tank.

5. Flow from the anoxic chamber(s) shall flow by gravity to the aeration chamber.

E. Aeration Chamber:

1. The aeration chamber shall be designed to meet the requirements set forth in the Design Requirements paragraph of this Section.

2. The aeration chamber and flow control baffles shall be designed in a manner which ensures maximum retention time and eliminates short circuiting, facilitates the rotation of the chamber contents, prevents sludge accumulation, and prevents scum and froth accumulation.

3. The chamber width to depth proportion shall not exceed 1.33 to 1 in the direction of rotation. The velocity of rotation shall be sufficient to scour the bottom and prevent sludge filleting.

4. The aeration chamber shall be provided with air diffusers, placed longitudinally along one side of the chamber.

5. Two mixed liquor recycle (MLR) pumps shall be supplied with a capacity of 200% of the daily average flow. Recycle pumps shall be located in the aeration chamber, as shown on the drawings.

6. The MLR pumps shall be of the Gould submersible type, or approved equal, rated for 3/4 HP 460 volt, 3 phase, 60 Hz service with maximum capacity of 90 gpm. The motors shall be rated for continuous duty under full nameplate load while at full submergence. The pumps shall be located in the aeration chamber, as shown. Each pump shall include a seal fail sensor. Pump guide rails shall be constructed of Type 316 stainless steel and discharge piping shall be constructed of Schedule 80 PVC.

7. Walkways shall be provided as needed for safe access to all valves, pumps and diffusers. Walkways shall be constructed of removable aluminum grating.

8. The system shall be provided with a Recycle Pump Local Control Panel (RPLCP). See P&IDs for required switches, indicator lights, controllers, etc. Provisions shall be made to RP-LCP for connection with two remote HOA switches (provided by others) as shown in the drawings. The panel shall be shipped loose for installation in the field. Refer to the Electrical and Controls section.

F. Air Distribution System:

1. The air distribution system shall consist of a peripheral air header, diffuser drop pipes, diffuser assembly, and two sets of two blowers (for a total of four blowers). There shall be two separate air distribution systems:
a. Flow equalization chamber: Air Supplied by two (2) blowers, each providing a minimum of 40 scfm at 5 psi as needed for complete mixing at half full or above.

b. Aeration basin: Air Supplied by two (2) blowers, each providing 150 scfm at 5 psi. Also supply air to sludge holding tank, sludge return pumps and scum skimmer pumps. Air supply must include valving to adjust and balance air delivery system.

2. Diffusers shall be located in the Flow Equalization Chamber, Aeration Chamber, and Sludge Holding Chamber. Diffusers shall be coarse bubble, Type 316 stainless steel, non-clog diffusers, or approved equal. An air distribution manifold shall be installed longitudinally along one side of the tank with diffuser drop assemblies connected thereto. The air manifold shall be Type 316 stainless steel. The body of the diffusers shall be constructed of Type 316 stainless steel. Provide a cast end cap with an integral 3/4" NPT male pipe connection.

a. A bottom deflector shall be incorporated into the diffuser to prevent foreign material from entering and clogging the air ports. The deflector shall deflect liquid across the outer walls of the diffuser and help to shear bubbles as they rise.

b. The diffuser ends shall be partially open to allow air to escape in the event of plugging of the diffuser openings.

c. A balancing orifice shall be provided as required within the 3/4" NPT male pipe connection to assure proper head loss and uniform distribution of the air throughout the system.

3. Each diffuser drop assembly shall be equipped with a Type 316 stainless steel air regulating and/or shutoff ball valve, a disconnecting union, and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. Each aeration zone drop pipe assembly shall include a flange to allow for ease of removal, a stainless steel ball valve accessible from the peripheral walkway for the purpose of air shut-off and regulation of the air supply, as well as all required pipe and fittings. All pipe and fittings for the Air Distribution System shall be constructed of Type 316 stainless steel.

4. Diffuser assemblies shall be designed with external check valve capability to prevent entry of mixed liquor into diffuser or air piping on air shutdown or interruption of air supply.

5. Air Supply for the Flow Equalization Chamber shall be provided by two (2) Roots Universal RAI Blowers, Model 22-URAI (3 hp, 460V, 3 phase, 60 Hz), or approved equal, installed as shown. Blower motors shall be rated for continuous duty. Blower operation shall be controlled in conjunction with the flow equalization pump floats.

a. Each blower shall have the capability of providing 100% of the air requirements of the flow equalization system.

b. Each blower shall be capable of delivering 40 scfm at an operating pressure of 5 psi.

c. Each blower shall provide the air required to keep solids in suspension.

d. Blowers shall be completely factory built and tested before shipping.

e. Blower discharge piping shall include, pressure relief valve, pressure gauge, one 1-inch blower discharge pipe with a 1-inch marine rubber hose and two (2) stainless
steel clamps, and rubber connection. These items shall be pre-mounted and piped within the blower enclosure.

d. The blower motor unit shall be factory pre-mounted on a steel skid. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers to reduce blower vibration and noise transmission.

g. The system starters, indicator lights, controllers, etc. shall be provided in the FE-LCP as specified in Section 2.3.B above.

6. The air header for the Aeration Chamber shall be designed to supply air to the aeration basin, as well as the diffusers in the sludge holding chamber, the airlift pumps in the clarifiers, and the scum skimmer in the clarifiers.

7. The Aeration Chamber air system shall be constructed of Type 316 Stainless Steel and designed to provide a minimum of 45 pounds of oxygen per day at average design flow and 100 pounds of oxygen per day at peak design flow. Oxygen transfer efficiency shall be guaranteed and substantiated by submission of test data compiled by a nationally recognized independent testing laboratory.

8. The air system in the Sludge Holding Chamber shall provide complete mixing and maintain 1.0 to 2.0 mg/L of dissolved oxygen in the mixed liquor at all times.

9. Air supply for the Aeration Chamber shall be provided by two (2) Roots, Universal RAI Blowers, Model 24-URAI (7.5 hp, 460 V, 3 phase, 60 Hz), or approved equal installed as shown. Blower motors shall be rated for continuous duty.

a. Each blower shall be capable of providing 100% of the oxygen requirements of the Aeration Chamber as described, as well as the air requirements of the Sludge Holding Chamber (mixing and airlift supernatant decant system), and the Clarifiers (return sludge airlift pumps and airlift scum skimmer system).

b. Each blower shall be capable of delivering, at minimum, 150 scfm at an operating pressure of 5 psi.

c. Blowers shall be completely factory built and tested before shipping.

d. Blower discharge piping shall include, pressure relief valve, pressure gauge, one 1-inch blower discharge pipe with a 2-inch marine rubber hose and two (2) stainless steel clamps, and rubber connection. These items shall be pre-mounted and piped within the blower enclosure e. The system shall be provided with a Main Air Blower Local Control Panel (MAB-LCP). The panel shall be shipped loose for installation in the field. See P&IDs for required switches, indicator lights, controllers, etc. Refer to the Electrical and Controls section, below and Section 40 60 05, Instrumentation and Control for Process Systems.

10. Each pair of blowers for the Flow Equalization Chamber and the Aeration chamber shall be installed within a single FRP enclosure, Tipton Environmental International Inc. model TEII-FE-2.5 or equal. The blower enclosure shall be complete with:

a. Gel coated FRP hood.

b. Inlet filter.

c. Silencer.
d. Hinged base with Type 316 stainless steel hardware.

e. Lifting handle.

f. Hood opening support system.

g. Locking clasp.

h. Aluminum air vent louver.

G. Clarifiers:

1. Provide one gravity, hopper-bottomed clarifier, designed to meet the requirements set forth in the Design Requirements section, above.

2. The clarifier shall consist of a clarifier influent assembly, sludge collector mechanism, effluent launderer and scum baffle, stilling well, scum removal system, and exterior splash baffles for the aerated zones. The slope of the hopper walls will not be less than 1.7 vertical to 1.0 horizontal. Settled sludge shall be returned from each sludge well to the anoxic chamber(s) by a positive displacement sludge return system. Settled sludge shall also have the capability of being wasted to the sludge holding chamber.

3. Clarifier Influent Assembly:

a. The clarifier influent assembly shall be constructed of ¼-inch minimum thickness carbon steel.

b. The influent assembly shall be designed to prevent settling of solids, as well as to prevent the backup of liquid in the aeration chamber during peak flows.

c. The inlet of the clarifier chamber shall be provided with an influent baffle to slow the velocity of the flow from the aeration chamber to aid the settling process. It shall prevent floatables and scum from entering the clarifier settling area.

4. Sludge shall be collected in the clarifier center sump and removed from the sump by means of an airlift pump.

5. A clarifier effluent launderer shall be provided around the inside periphery of the clarifier to collect the supernatant. The launderer shall be designed to handle peak flows without becoming submerged.

6. A notched aluminum weir plate shall be attached to each side of the launderer and shall be vertically adjustable for leveling.

a. The weir plate shall be fabricated from 1/8-inch thick aluminum with 1¾-inch deep V-notches on 2½-inch centers.

b. Gasketing material, 3/8-inch thick x 1½ inches wide, shall be attached to the back of the weirs to prevent leaks.

c. An FRP scum baffle shall be provided to prevent floating scum from being carried over the weir. The scum baffle shall project a minimum of 18 inches below and 6 inches above the clarifier water surface and shall be attached to the launderer support brackets.

d. The clarifier effluent shall pass over the edge of the baffled adjustable effluent weir plate into the effluent trough, one trough for both clarifiers.
7. The sludge return piping from each sludge well shall be configured such that each hopper bottom can be isolated from the other with valving, as shown.

H. Scum Removal System:

1. Each clarifier shall be equipped with two 2-inch diameter positive airlift pump type skimming systems for removal of the scum from the collection trough and the clarifier inlet baffle. Skimmer piping and valves shall be Schedule 80 PVC, except for the air distribution piping, which shall be constructed of Type 316 stainless steel.

2. Air shall be supplied by the aeration basin blower. The airline supplying air to the skimming device shall be equipped with a needle valve to regulate the rate of return.

3. The scum intake shall be equipped with an adjustable assembly, enabling operator to control the position of the skimmer at water level without contacting the wastewater. The discharge port shall be sloped for manual determination of flow rate.

4. All valves shall be accessible to the operator without the need to remove floor panels.

I. Return Sludge System:

1. A return sludge system shall be provided to transport settled sludge in the clarifier to the anoxic chamber(s).

2. The return sludge system shall consist of a positive sludge re-circulation pumping system utilizing airlift pumps, one in each clarifier.
   a. All sludge return piping and valves shall be painted Schedule 80 PVC. All valves shall be Schedule 80 PVC True Union ball valves.
   b. Each clarifier hopper-bottom shall be equipped with one 4-inch diameter airlift sludge return assembly, consisting of the following:
      1) An airlift pump system with a re-circulation capacity ranging from 0% to 150% of the daily average flow.
      2) Airline supplying air to the pump, equipped with an air control valve to vary the capacity of the pumping rate.
   c. Air for the airlift pumps shall be supplied by the aeration basin blower.
   d. The airlift pumps shall be firmly supported and shall be equipped with a clean-out plug to allow for easy cleaning and maintenance.

J. Sludge Holding Chamber:

1. A sludge holding chamber shall be provided with capacity to store waste sludge for a minimum of 14 days based on the daily average flow rate.

2. Waste sludge shall be manually directed to the sludge holding chamber, transported by the return sludge piping system.

3. The sludge holding chamber shall be equipped with a supernatant decant airlift system to transfer supernatant back to the secondary treatment system for processing and to concentrate sludge solids.
4. The chamber shall be aerated. Diffused air shall be supplied by the aeration basin blower. The diffusers and diffuser piping shall be as specified for the aeration chamber.

5. Emergency overflow weirs shall be installed in the wall between the aeration basin.

K. Disinfection System:

1. Provide a chlorine contact chamber with a minimum volume to provide a 15 minute detention time based on the peak daily flow rate and a minimum chlorine residual of 0.5 mg/L.

2. Provide a 3-inch tablet chlorine disinfection system, Sanuril 1000 Tablet Chlorinator, or approved equal, located as shown.

3. Provide a V-notch weir for flow measurement at the effluent of the chlorine contact chamber. The V-notch weir shall be constructed of Type 316 Stainless Steel including mounting hardware.
   a. Manufacturer shall provide a stainless steel mounting bracket over upstream of V-notch weir to mount an ultra-sonic level sensor.
   b. Manufacturer shall provide aluminum staff gauge with graduations marked in feet, tenths, and hundredths zeroed to V-notch weir.

L. Effluent Flow Measurement:

1. The effluent flow meter shall be installed upstream of the V-notch weir of the chlorine contact chamber. The flow meter shall be an ultrasonic, open channel type as specified in Instrumentation and Control for Process Systems. The effluent flow meter shall be furnished and installed by the instrumentation and control integrator.

M. Portable Hoist and Winch Assembly:

1. A portable hoist and winch assembly shall be provided for lifting the pumps and mixers from each basin.

2. The hoist shall be constructed of Type 316 Stainless Steel tubing, with a 500 pound loading capacity.

3. Stainless steel wall mounted sockets shall be bolted to the hand rail and angle iron support to allow easy placement of the portable hoist and winch assembly.

4. A hand crank shall automatically locate at any position upon release.

5. A heavy duty safety hook and 30 feet of ¼-inch thick stainless steel cable shall also be provided.

N. Packaged Plant Effluent Connection: 1. The effluent connection of the Packaged WWTP shall consist of one (1) 6” diameter standard flanged Schedule 80 PVC pipe, as shown.

2.5 WALKWAYS, GRATING, AND STAIRS

A. Walkways:

1. Service walkways shall be provided for access to, and maintenance of, all plant equipment, valves, clarifier weir, and all air diffuser drop pipes and regulating valves.
2. All grating panels shall be constructed of skid-resistant aluminum with maximum yield strength of 37,000 psi.

3. All walkways shall be a minimum of 24 inches wide and have a deck made of 1-inch aluminum “I-Bar” grating adequately supported to withstand a live load of 100 lbs. per square foot, minimum.

B. Handrails:

1. Shall be provided around the perimeter of the service walkway and access stair

2. The handrail system shall consist of two-rail, 1½-inch-diameter Schedule 40, anodized aluminum pipe, and 4-inch by ¼-inch aluminum toe plate.

3. Railing shall be designed in accordance with OSHA Standard 1910.23.

4. Limit deflection in each single span of railing and handrail to 1.5-inch maximum, and to 1/4-inch maximum on railing posts. Applied loads shall not produce permanent deflection in the completed Work when loads are removed.

C. Aluminum Access Stair:

1. Shall be provided as shown on Drawings.

2. Railing shall be provided as described above.

3. Access stair shall be designed in accordance with OSHA Standard 1910.24.

4. Access stair shall be a minimum of 30 inches wide and have grating treads made of 1-inch aluminum “I-Bar” grating adequately supported to withstand a live load of 100 lbs. per square foot, minimum.

2.6 ELECTRICAL AND CONTROLS

A. General:

1. All provided panels shall comply with UL 50 and UL 508A, and be provided in powder coated white, NEMA 4X enclosures with sunshields.

2. The motor and auxiliary branch circuits shall be protected by circuit breakers.

3. The control voltage shall be 120 volts AC. This voltage shall be supplied from a single phase transformer.

4. Switches, indicator lights, alternators, timers, etc. shall be furnished and installed per the drawings and as specified in Electrical Work.

5. All control panels shall be completely factory assembled and tested prior to shipment.

6. The following local control panels shall be provided for each system:

   i. FE-LCP - Flow Equalization Local Control Panel

   ii. AM-LCP - Anoxic Mixer Local Control Panel

   iii. RP-LCP - Recycle Pump Local Control Panel

   iv. MAB-LCP - Main Air Blower Local Control Panel
B. Flow Equalization Local Control Panel (FE-LCP)

1. The incoming service to the panel shall be 480 volts, 3 phase, 60 Hz.
2. A step down transformer shall be supplied by the Manufacturer to step the electrical power down from 480 volt to 120-volt power for control voltages for the secondary power.
3. The FE-LCP shall control the operation of the following equipment:
   a. Flow Equalization Blower Motor Unit BM-1, 3 HP, 460 volts, 3 phase, 60 Hz.
   b. Flow Equalization Blower Motor Unit BM-2, 3 HP, 460 volts, 3 phase, 60 Hz.
   c. Flow Equalization Pump No. 1: P-1, 1/2 HP, 460/3/60.
   d. Flow Equalization Pump No. 2: P-2, 1/2 HP, 460/3/60.
   e. Liquid level sensors -4 float switches.
   f. Time Clock Control.
   g. Seal fail sensor for each pump.
4. Motor starters and overcurrent protection shall be provided as specified in Electrical Work.
5. Control panels, panel mounted instruments, and appurtenances shall be provided as specified in Instrumentation and Control for Process Systems.
6. Flow Equalization Blowers - The flow equalization blowers shall be controlled either manually by the HOA switches located at the FE-LCP, or automatically by a duplex controller/alternator which changes the duty/standby blower designation based on two (2) of the four (4) float switches as described in 2.6.B.7 below.
7. Flow Equalization Pumps - The flow equalization pump operation shall be controlled either manually by the HOA switches located near the pumps, manually by the Start/Stop push buttons at the FE-LCP, or automatically by four (4) float switches, each individually adjustable for the following:
   a. All Pumps & Blowers off
   b. Lead Pump and Duty Blower on
   c. Lag Pump on
   d. High Level Alarm. A duplex pump alternator shall change the lead/lag pump designation after all pumps are turned off. If the liquid level reaches the high water level, the alarm will be activated. 8. All wiring, terminal blocks, supports and accessories required for the operations of the control panel shall be provided in compliance with the National Electric Code.

C. Main Air Blower Local Control Panel (MAB-LCP)

1. The incoming service to the panel shall be 480 volts, 3 phase, 60 Hz.
2. A step down transformer shall be supplied by the Manufacturer to step the electrical power down from 480 volt to 120-volt power for control voltages for the secondary power.

3. The MAB-LCP shall control the operation of the following equipment:
   a. Main Air Blower Motor Unit BM-3, 7.5 HP. 460/3/60
   b. Main Air Blower Motor Unit BM-4, 7.5 HP. 460/3/60
   c. Time Clock Control.

4. Motor starters and overcurrent protection shall be provided as specified in Section 26 00 05, Electrical Work.

5. Control panels, panel mounted instruments, and appurtenances shall be provided as specified in Section Instrumentation and Control for Process Systems.

6. Main Air Blowers - The main air blowers shall be controlled either manually by the HOA switches located at the MAB-LCP, or automatically by a duplex controller/alternator which changes the duty/standby blower designation based on a time clock (adjustable).

7. All wiring, terminal blocks, supports and accessories required for the operations of the control panel shall be provided in compliance with the National Electric Code.

D. Recycle Pump Local Control Panel (RP-LCP)

1. The incoming service to the panel shall be 480 volts, 3 phase, 60 Hz.

2. A step down transformer shall be supplied by the Manufacturer to step the electrical power down from 480 volt to 120-volt power for control voltages for the secondary power.

3. The FE-LCP shall control the operation of the following equipment:
   c. Seal fail sensor for each pump.

4. Motor starters and overcurrent protection shall be provided as specified in Electrical Work.

5. Control panels, panel mounted instruments, and appurtenances shall be provided as specified in Instrumentation and Control for Process Systems.

6. Recycle Pumps - The recycle pump operation shall be controlled either manually by the HOA switches located near the pumps, manually by the Start/Stop push buttons at the RP-LCP, or automatically by a duplex controller/alternator which changes the duty/standby pump designation based on a time clock (adjustable).

7. All wiring, terminal blocks, supports and accessories required for the operations of the control panel shall be provided in compliance with the National Electric Code.

E. Anoxic Mixer Local Control Panel (AM-LCP)
1. The incoming service to the panel shall be 480 volts, 3 phase, 60 Hz.

2. A step down transformer shall be supplied by the Manufacturer to step the electrical power down from 480 volt to 120-volt power for control voltages for the secondary power.

3. The AM-LCP shall control the operation of the following equipment:
   a. Anoxic Mixer AM-1, 1/2 HP. 460/3/60 Main Secondary
   b. Anoxic Mixer AM-2, 1/2 HP. 460/3/60 Main Secondary

4. Motor starters and overcurrent protection shall be provided as specified in Electrical Work.

5. Control panels, panel mounted instruments, and appurtenances shall be provided as specified in Instrumentation and Control for Process Systems.

6. Anoxic Mixers - The anoxic mixers shall be controlled either manually by the HOA switches located at the mixers, or manually by the Start/Stop push buttons at the AM-LCP.

7. All wiring, terminal blocks, supports and accessories required for the operations of the control panel shall be provided in compliance with the National Electric Code.

2.7 TOOLS AND SPARE PARTS

A. General: Furnish all special tools that are required to assemble, disassemble, repair, and maintain any item of mechanical equipment. Special tools shall include any type of tool that has been specifically made for use on an item of equipment for assembly, disassembly, repair, and maintenance. When special tools are provided they shall be marked or tagged, and a list of such tools shall be included with maintenance and operation instructions describing use of each marked tool.

B. Provide:
   1. Two sets of spare belts for each blower.
   2. Two sets of inlet filters for each blower.
   3. Two coarse bubble diffusers.

C. Spare parts shall be packed in sturdy containers with clear indelible identification markings, referencing the equipment that they are intended for, and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project. Provide complete ordering information including manufacturer, part number, part name and equipment for each part to be used.

2.8 SURFACE PREPARATION AND PROTECTIVE COATINGS

A. Motors, drives, frames, steel plates, appurtenances, etc., shall receive shop primer and shop finish coating conforming to the requirements of Painting. If any damage to the paint system occurs, the equipment shall be repainted as directed by the ENGINEER.

B. Surface preparation and painting shall conform to the requirements of Section 09800, Painting.
C. All steel surfaces shall receive a near white blast to remove rust, mill scale and weld slag. All weld splatter and surface roughness shall be removed by chipping and grinding smooth. Blasting shall be accomplished indoors using steel shot to produce a mil profile for optimum adhesion of the primer.

D. All prepared surfaces shall be thoroughly dry and free from preparation dust and foreign matter prior to the application of any coating. All materials shall be evenly applied and shall be free from obvious defects.

E. Protective coatings shall not be applied to improperly prepared surfaces or during conditions considered to be not conducive to sound painting practices or in fog, rain, snow, mist or when the surface temperature is less than 40°F. or the humidity exceeds 85 percent.

F. Immediately after surface preparation, a rust inhibitive epoxy primer coat shall be applied. No discoloration of the cleaned areas shall occur prior to the application of the prime coat. All steel surfaces shall receive a 3 mil dry film thickness of Sherwin Williams B62Y110 Copoxy primer, or equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the conditions under which the Work is to be installed and notify the ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 UNLOADING AND SETTING

A. Packaged WWTP manufacturer shall inform the contractor, prior to system shipment, of the calculated weight of the treatment plant.

B. Crane to off-load and set the Packaged WWTP onto the concrete slab shall be provided by the CONTRACTOR.

C. Setting of the Packaged WWTP and connection to influent and effluent piping and power, anchoring of the Packaged WWTP, and thrust blocking of the influent and effluent piping that is connected to the Packaged WWTP shall be the responsibility of the CONTRACTOR.

3.3 INSTALLATION

A. CONTRACTOR shall provide all materials, equipment, and labor necessary to install and connect the Packaged WWTP system.

B. Installation of the Packaged WWTP shall be completed by the CONTRACTOR as specified and in accordance with the Manufacturer's written instructions. The Manufacturer's technical representative shall be available for consultation prior to and during installation. The final installation must be certified by the Manufacturer as correct prior to start-up. The Manufacturer's technical representative performing this service shall be a direct employee of the equipment Manufacturer, normally engaged in this type of service work.

C. Installation shall encompass the total treatment plant assembly, as required for a complete and operable WWTP. Installation shall also include leveling and adjusting weir plates, scraper assemblies, air regulation valves, skimmings trough, and other ancillary equipment.
CONTRACTOR shall include furnishing and applying an initial supply of lubrication, as recommended by the Manufacturer.

D. Perform the following inspection of equipment with the equipment manufacturer’s representative.
   1. Verify proper equipment mounting and setting.
   2. Verify that control, interlock and power wiring is complete and operational.
   3. Verify alignment of each motor and drive.
   4. Verify proper piping connections and accessories.
   5. Verify that lubrication has been completed.
   6. Verify direction of rotation.
   7. Verify setting of safety controls.
   8. Monitor heat build-up in bearings.
   9. Check motor loads against nameplate data.
  10. Verify function of safety and operating controls.
  11. Verify proper operation of equipment.
  12. Remove debris and waste materials resulting from installation.

3.4 PACKAGED WWTP START-UP

A. CONTRACTOR shall check and approve the installation of all anchoring, piping, control system components, and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.

B. CONTRACTOR shall perform a hydrostatic test on the Packaged WWTP compartments, initially filling the plant with water to test the hydrostatic design. Any leaks, failures, or excessive deflection shall be remedied and all costs shall be borne by the manufacturer.

C. CONTRACTOR shall conduct a complete system checkout and adjustment, including all equipment, calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in startup of the various unit processes.

D. Additionally, Manufacturer's representative shall check and approve the installation before operation. The Manufacturer's representative shall test the system in the presence of the ENGINEER, verify that the system conforms to the specified requirements, and instruct plant personnel on care and maintenance of the equipment. Provide the Manufacturer's representative to revisit the job site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

E. Once the installation of the Packaged WWTP has been certified by the Manufacturer, the CONTRACTOR, with assistance from the Manufacturer’s qualified technical representative shall provide field engineering to start-up, stabilize, and test at proper operating conditions.
F. The start-up, or acclimation period, for the Packaged WWTP shall take no longer than four weeks. At any point during this startup period, at the discretion and direction of the Manufacturer, the CONTRACTOR shall switch the system over to normal operation. CONTRACTOR shall haul at least one 5,000 to 10,000 gallon load of mixed liquor from existing WWTP to seed plant. The ENGINEER shall make arrangements for pickup.

G. After satisfactory startup and the corresponding switch over to normal operation, the CONTRACTOR shall, in the presence of the ENGINEER, conduct the performance test as detailed in Paragraph 3.6 below.

3.6 PACKAGED WWTP PERFORMANCE TESTING

A. Performance testing of the Packaged WWTP shall not commence until after CONTRACTOR and ENGINEER have mutually agreed that the Packaged WWTP has been satisfactorily started-up. CONTRACTOR and a qualified field service representative of the Manufacturer shall conduct an operating test of the Packaged WWTP equipment and controls in the presence of ENGINEER to demonstrate that the equipment and its controls will function correctly.

B. General: CONTRACTOR and Manufacturer at their sole cost shall conduct Packaged Wastewater WWTP performance tests following completion of process start-up. The field acceptance tests shall be initiated within 45 days of process startup. Field acceptance tests shall be coordinated and scheduled with OWNER. The time of the performance test and detailed test procedure shall be submitted for approval by the ENGINEER at least 30 working days prior to testing. Performance testing shall be conducted by the CONTRACTOR on the Packaged WWTP for at least 30 consecutive days. During performance testing, the plant must be operated or 10 consecutive days within 90% of the average hydraulic loading rate. The ENGINEER may make periodic site visits during the performance test and the results will be furnished to the ENGINEER in writing within 14 days of completion of the performance test. 1. CONTRACTOR shall provide all equipment required for conducting the performance testing. 2. During testing, significant changes in Packaged WWTP operating conditions shall not be permitted without the consent of the ENGINEER. All fine-tuning of operating conditions shall be performed prior to testing.

C. Test Procedure:

1. During the field acceptance tests, daily grab samples shall be obtained. CONTRACTOR shall take the samples and have them analyzed by an OWNER approved laboratory. If requested by OWNER, CONTRACTOR will provide split samples after such request for analysis by another certified laboratory at OWNER’s expense. The test results shall be used to calculate weekly and monthly averages. The performance tests will have been met if after 30 days of operation, the weekly averages are equal to or better than the values specified in the Design Requirements, Paragraph 2.2 of this Section. Testing shall be completed in accordance with Standard Methods for the Examination of Water and Wastewater, latest edition and EPA 40CFR136.

2. The following recordings and samples shall be taken, analyzed and weekly and monthly averages calculated:
   a. Plant Influent:
1) TSS (mg/L).
2) CBOD5 (mg/L).
3) TKN (mg/L).
4) Ammonia-N (mg/L)
5) Total P (mg/L).

b. Plant Effluent:
1) Flow (gal/day).
2) TSS (mg/L).
3) CBOD5 (mg/L).
4) Ammonia-N (mg/L)
5) Nitrate-N (mg/L).
6) Total P (mg/L)

D. In the event that the Packaged WWTP does not meet the Design Requirements during the field acceptance tests, the Packaged WWTP Manufacturer and CONTRACTOR will be permitted to make changes to the equipment and methods of operation at the Manufacturer’s and CONTRACTOR’S sole expense. The re-adjustments shall be made as soon as practicable within a period not to exceed 30 days. Following the readjustments, the CONTRACTOR and Manufacturer at their sole expense (including all sample collection, delivery, and laboratory costs) shall make a second test run similar to the first. Additional testing of any equipment that has been repaired, modified or replaced shall be conducted in accordance with the procedure for the initial acceptance test described above. Conformance with the Design Requirements for a period of 30 consecutive days must be achieved before the Packaged WWTP will be deemed acceptable. A maximum of two retests shall be allowed to show conformance with the Design Requirements. However, after initial start-up, OWNER shall have the right to use the equipment as needed to treat wastewater until an accepted, or if rejected, until acceptable replacement system or modified system is available for use.

E. Satisfactory completion of the performance tests does not release CONTRACTOR from other guarantees required by the Contract Documents or provided by law.

F. A report describing the performance tests and results shall be submitted to OWNER and ENGINEER. This report shall summarize pertinent details regarding the tests as well as test results to demonstrate that the tested equipment complies with the specified Design Requirements.

3.7 MANUFACTURER’S SERVICES

A. Factory trained representative(s) shall be provided for installation supervision, startup services, performance testing services, and operation and maintenance personnel training services. The representative shall visit the Site a minimum of three days, minimum eight hours on-site for each day at the Site. The first visit shall be for checking the completed installation and start-up of the system. Manufacturer's representative shall test operate the
system in the presence of the ENGINEER and verify that the Packaged WWTP conforms to the requirements. The second visit shall be to assist performance tests and initial operation. The third visit shall be as described under Section 01 79 23, Instruction of Operations and Maintenance Personnel. Manufacturer's representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory at no additional cost to OWNER.

B. All costs, including travel, lodging, meals and incidentals shall be considered as included in CONTRACTOR'S bid price.

C. Reports: The manufacturer's supervising Engineer shall submit a report of each visit to the Site. Reports shall provide complete information on time, schedule, tasks performed, persons contacted, problems corrected, test results, training, instruction and all other pertinent information.

END OF SECTION
SPECIFICATION 13000

POLYURETHANE RAPID DRAINING SLUDGE FILTER BED SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope

The work included in this section covers the installation of the filter bed media.

B. Description of Operation

Batch quantities of digested sludge are directed over the drying beds. Immediate separation of water drains through the filter bed media. Dried sludge is collected off the media.

C. System Design Data

Sludge Drying Beds Quantity: 2 (ea.)
Measuring: x
Total Wedgewater Filter Area: 580 sq. feet.
Sludge Wasted per Cycle: lbs. dry solids
Application Rate (Maximum): lbs. dry solids / sq. ft.

Sludge shall be dried to a liftable, truckable state when loaded at the required application rate. operated at a frequency of one cycle(s) per week.

There will not be any exceptions to the total area to be provided, the loading rates or cycle times specified herein. These amounts are intended as minimum values to provide an adequately dewatered sludge cake while allowing the owner maximum flexibility in the operation of his dewatering system.

D. Experience

The manufacturer shall have a minimum of ten (10) years’ experience in the design and manufacture of the type of these types of facilities.

1. The manufacturer shall also be able to provide the Engineer a reference list of at least twenty-five (25) similar installations that includes the following information:

a. Location – including mailing address.

b. Contact person with telephone number

c. Size of system furnished

2. Only single-piece media blocks will be considered for this project.

3. Only media manufactured from polyether thermoplastic polyurethane (TPU) will be considered for this project. Polypropylene, polyethylene, PVC, or any other materials will not be accepted for this project.
4. The manufacturer will certify that his equipment is suitable for the use of articulated steering front-end loaders for cleaning the beds. The manufacturer shall also provide one plastic-tipped blade extension for the Owner’s sludge loading equipment as part of the equipment furnished herein.

1.2 QUALITY ASSURANCE

A. Manufacturer

The filter bed media shall be as furnished by Gravity Flow Systems Southwest, Dripping Springs, Texas or Engineer pre-approved equal.

1. The individual filter media modules shall measure 12” from one flat side to the opposite flat side in both directions, within a ±1/32” tolerance, for reasons of manufacturing consistency, replacement and interchangeability. If requested by the engineer, the media manufacturer shall provide ten (10) sample modules to him for verification purposes and, when interconnected end to end, shall measure not more than 10’-0 5/16”, nor less than 9’-11 11/16”, when dimensionally stabilized at between 60° and 80° Fahrenheit. Media failing to meet these dimensional requirements shall be unacceptable.

PART 2 - PRODUCTS

2.1 FILTER MEDIA BED EQUIPMENT CONSTRUCTION

A. Media:

The filter media modules shall be constructed of high strength polyurethane having shore Durometer hardness readings of no less than 70. The modules shall measure 2” high x 12” x 12” and have incorporated within sufficient structural design to be able to support the weight of sludge removal equipment weighing up to 4,000 lbs. GVW. The filter modules shall have a solid area of 88% formed by the molding of triangular cross-sections measuring .105” wide x .170” high tapered at 13 degrees per side. These triangular sections are separated by an open area of .015” wide x 1.00” long slots. The polyurethane shall be protected against UV deterioration. The modules shall have two male dovetails on two sides and two female dovetails on two sides to allow for interlocking. The interlocking shall be designed to allow any module to be removed without disturbing any other modules.

B. Perimeter Sealing:

The filter media shall be sealed on all perimeter edges by a min. 4” x 4” 11 gauge T304 stainless steel angle. The angle shall be complete with 1/16” thick x 1” wide neoprene rubber strips adhered to each leg of the angle. The angle shall be placed in such a manner that one rubber strip rest tightly against the media and one rests against the concrete sidewall. The angle shall be held in place by ½” x 3 3/4” stainless steel wedge anchors located on maximum 18” centers. After the angles are installed, any gaps that may occur should be caulked with a suitable weatherproof silicon caulking, furnished by the General Contractor.

C. Anchorage:

All anchorage for the filter media and its appurtenances shall be Type 18-8 stainless steel. Anchorage bolts, nuts and washers shall be placed in position by the Contractor according to certified dimension prints furnished by the equipment manufacturer.
D. Splash Plates:

Each sludge drying bed shall be complete with one (1) splash plate per feed point. Splash plates shall be 24” x 24” x 11 gauge thick type 304 stainless steel, and shall be secured in place as recommended by the manufacturer.

E. Entrance Seal Plates:

Each bed shall have an 8” wide 11 gauge type 304 stainless steel flat seal plate located at the entrance to the beds and spanning the entire width of the entrance. The plates shall be sealed with two (2) 1/16” x 1” neoprene rubber strips. The plates shall be held in place by stainless steel concrete anchors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer’s Service Representative

The manufacturer shall furnish the services of a competent service technician to inspect the installation and to place the equipment into operation.

1. The contractor shall include in his bid the services of a factory representative for a period of one (1) day(s) and one (1) separate trip(s) to the project location.

2. Checkout of final installation, start-up, calibration, and instruction of operation personnel shall be performed by an authorized representative of the manufacturer.

B. Sealants

The Contractor shall furnish and apply all waterproofing caulking compound for sealing of the media modules.

END OF SECTION
SECTION 13120

PRECAST CONCRETE BUILDING PRE-ASSEMBLED

PART 1 – GENERAL

a. SUMMARY

A. Contractor to furnish a precast concrete building 25’8” X 9’0” X 9’0” Interior Height and will be plant assembled. Roof and floor of the building are to be post-tensioned. Basis of design for the building is by Leesburg Concrete Company Incorporated. Building is to be delivered and placed/assembled on owner’s prepared stone foundation in accordance with the manufacturer’s recommendations. The building will be provided with all necessary openings as specified by the owner. Building will be engineered to meet applicable building codes. Plans to be stamped by an engineer licensed to practice engineering in the state of building delivery.

B. The Purchaser may also allow other firms to become qualified to bid, but any firms so authorized to bid must fully comply with these bid specifications and plans or be subject to post bid rejection. In order to provide full and open competition, other firms may request approval as an “or equal,” however the Contractor must provide separate line item pricing for the “or equal” building in addition to pricing for the “selected” building.

1. Or Equal applicant shall provide with their bid submission, scaled floor plans and elevations, to show general architectural design criteria is met.

2. Or Equal applicant shall provide with their bid submission, a written list of each and every deviation from the published bid specifications/plans. Lack of specificity to each deviation from the bid specifications will be cause for rejection.

3. Or Equal applicant shall provide with their bid submission, manufacturer’s certification of test compliance from a national independent testing laboratory (within the past year) to support the claim for absorption resistance of the slab type that will be used in their proposed building. The written report must state the concrete compressive strength (minimum 5,000 PSI) and absorption resistance (not greater than 3%) per ASTM standard ASTM C39/C39M-12a and C642, respectively. Test results must be no older than six months.

4. Or Equal applicant must provide a list of every building they designed and built over the last 3 years utilizing the same building materials/systems design criteria as published in this bid. Provide date of building bid, date of completion and most knowledgeable owner contact.

5. Or Equal applicant shall be responsible for and bear all cost for architecture, plan checks, design and structural engineering and all fees in obtaining approvals and permits from applicable agencies.
b. QUALITY ASSURANCE


C. IBC 2018 and Florida Building code 2017 supplement. Buildings located in other states will have appropriate state sealed calculations and drawings.

D. Concrete Reinforcing Institute, “Manual of Standard Practice”.

E. UL-752 test method level 5 for jacketed military bullet resistance certified by a recognized ballistic laboratory.

F. Fabricator must be a certified producer/member of National Precast Concrete Association (NPCA) and/or PCI (Precast, Prestressed Concrete Institute) and have a central mix precast plant with covered production.

G. Producer must have documented QA/QC program approved by NPCA or PCI.

H. Building fabricator must have 3 years minimum experience manufacturing and setting transportable precast concrete buildings and field assembled precast buildings.

I. Must meet PCI 122 Fabrication Tolerance and PCI 117 for Erection Standards.

c. DESIGN REQUIREMENTS

A. Design Loads:

   1. Seismic Design Category ‘C’, Importance Factor 1
   2. Standard Live Roof Load – 60 PSF
   3. Standard Floor Load – 250 PSF
   4. Standard Wind Pressure for the geographic region under ASCE 7-10

B. Roof: Roof panel shall maintain a 1/8” per linear foot slope on the 12’ side. The roof shall extend a minimum of 3” beyond the wall panel on each side and have a turndown design which extends ½” below the top edge of the wall panels to prevent water migration into the building along top of wall panels. All roof panels will have post tensioning with larger roof sections having two-way post tensioning forming a monolithic diaphragm. Larger roof sections will be joined with a grouted keyway, welded imbedded connections as shown on the building plans. If post-tensioning is not used in the roof panel, the following guidelines must be followed to ensure a watertight roof design:

   1. The entire precast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.
2. The entire precast concrete roof panel surface shall be sealed with a .045 EPDM continuous membrane cemented to the concrete with a compound designed for this purpose.

3. The concrete roof must be increased in thickness by 1” to gain the same punch shear capacity as post tensioning provides.

C. Roof, floor, and wall panels must each be produced as single component monolithic panels. Roof and floor will be post tensioned. Wall panels shall be set on top of floor panel to prevent hydrostatic pressure on the floor to wall joint.

D. Floor panel must have ½” step-down around the entire perimeter to prevent water migration into the building along the bottom of the wall panels.

E. All panel joints will be caulked inside and out with Sikaflex A-1.

d. SUBMITTALS

A. Engineering calculations that are designed and sealed by a professional engineer, licensed to practice in the state where building will be located shall be submitted for approval.

PART 2 – PRODUCTS

1.1 MATERIALS

2Concrete: Steel-reinforced, 5000 PSI minimum 28-day compressive strength, Optional air-entrained (ASTM C260) concrete where required. Test results showing conformance from a certified lab are required to be submitted.

3Reinforcing Steel: ASTM A615, grade 60 unless otherwise specified.

A. Post-tensioning Strand: 41K Polystrand CP50, .50, 270 KSI, 7-wire strand, enclosed within a greased plastic sheath, (ASTM A416), roof and floor to be each post-tensioned by a single, continuous tendon in a loop. Said tendon shall form a substantially rectangular configuration having gently curving corners wherein the positioning of the cable member results in a pattern of one or more loops and a bisecting of the loop(s). The cable member starts from one corner of the concrete building panel, forms a gentle perimeter loop(s) returning to a point where the cable member entered the concrete building panel. The tendon then turns 90 degrees and follows the cable member(s) to a point midway along the “Y” axis of the concrete building panel and then turns 90 degrees along the “X” axis of the concrete building panel. This bisects the concrete building panel and crosses the opposite parallel portion of the cable member and exits from an adjacent side of the concrete building panel.

B. Caulking: All joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant or equal. Exterior caulk joint to be 3/8” x 3/8” square so that sides of joint are parallel for correct caulk adhesion. Back of joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint and not the back.

C. Panel Connections: All panels shall be securely fastened together with 3/8” thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A283, Grade C and hot dipped galvanized after fabrication. All fasteners to be ½” diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections to be
Dayton-Superior #F- 63 or equal. All inserts for corner connections must be bolted directly to form before casting panels. No floating-in of connection inserts shall be allowed. Alternate welded plate connections may be used if shown in the drawings.

D. ALTERNATE ACCEPTABLE PANEL CONNECTIONS: Precast panels may be welded together with 3/8” steel plates imbedded with galvanized nelson welded anchors using standard full-length fillet welds ground smooth and then primed and epoxy painted as shown on the drawings where specified.

1.2 ACCESSORIES/OPENINGS

C. Doors and Frames: Shall comply with Steel Door Institute “Recommended Specifications for Standard Steel Doors and Frames” (SDI-100) and as herein specified. The buildings shall be equipped with 1-3/4”, 18-gauge galvanized/insulated 1 right hand reverse metal doors with 16-gauge galvanized frames. Doors and frames shall be bonderized and painted one coat of rust inhibitive primer and one finish coat of enamel paint; color to be to customer’s choice.

D. Doors must have FL Approval number.

E. Windows will be translucent in nature and meet Florida Approval Codes

F. Vents shall meet Florida Approval Codes

1.3 FINISHES

A. Interior of Building: Troweled form finish on all interior panel surfaces.

B. Exterior of Building: Architectural precast light broom grey concrete or form lined stained as shown in the drawings; formliner finish as selected by Purchaser.

C. 3 Coat Paint System by Sherwin Williams consisting of Base Loxon Conditioner/Primer and 2 Topcoats of Sherwin Williams SUPERPAINT (color TBD).

D. OPTIONAL: Apply Sherwin Williams Anti-Graffiti Coating to exterior concrete walls, or equal.

PART 3 – EXECUTION

3.1 SITE PREPARATION REQUIREMENTS (MANUFACTURER’S RECOMMENDATION)

A. Building shall bear fully on a crushed 3/8” stone base that is at least two feet larger than the length and width of building on the sides not trenched for plumbing and electrical access.

B. Stone shall be a minimum of 4” thick or down to firm subgrade. The vertical soil capacity under stone shall be compacted to have minimum bearing of 1,500 pounds per square foot. Stone shall be 3/8” or smaller and must be screeded level within 1/4” in both directions. Stone shall be placed within a perimeter form with flat and level top edge for screeding. Forming material shall remain around stone until after the building is set.

C. The crushed stone base shall be kept within the confines of the soil or perimeter form. Do not allow the base to become unconfined so that it may wash, erode, or otherwise be undermined. Proper water drainage away from the building site is required.
OR

If building is placed on pavement or a concrete slab, substrate below pavement or slab must have a vertical soil capacity of 1,500 pounds per square foot. Place stone or sand to 1” above highest point of area where building will be placed and at least 1’-0” wide all around the building footprint. Retain stone or sand with a perimeter form to prevent the material from washing out.

If Contractor supplies Slab on Grade:

1. NO deviation in height greater than 1/8” in 10’ from SOG highest point

Embedded Connection

2. Deviation of no greater than 1/8” vertical from highest point within 10’ on slab

3. Deviation horizontally of 1/4” in any direction

D. Provide positive drainage for the fill, pad, or slab as required including the electrical and plumbing formed access trench when used.

3.2 ACCESS

A. Purchaser must provide level unobstructed area large enough for a crane and a tractor-trailer to park adjacent to the pad. Crane must be able to place outriggers within 5’-0” of edge of pad and truck and crane must be able to get side by side under their own power. No overhead lines may be within 75’ radius of center of pad. A minimum of 24” clearance is required between this building and adjacent buildings.

END OF SECTION
SECTION 15051

BURIED PIPING INSTALLATION

PART 1 — GENERAL

1.1 DESCRIPTION

A. Work Specified
   The work specified shall include all labor, material, equipment, services and incidentals necessary to furnish and install watermain, specials and fittings, install fire hydrants and to perform interconnections and abandonments as shown on the plans and specified herein.

1.2 QUALITY ASSURANCE

B. Reference Standards
   1. AWWA Standards identified in other related sections
   2. ASTM Standards identified in other related sections
   3. ANSI Standards identified in other related sections
   4. Occupational Safety and Health Administration (OSHA)
   5. 1996 Safe Drinking Water Act
   6. NSF/ANSI Standard 60 and 61, as applicable
   7. All other standards itemized in related work sections

1.3 SUBMITTALS

C. Shop Drawings
   Prior to obtaining any products in relationship to this Section, the CONTRACTOR shall submit detailed shop drawings and data for review by the ENGINEER.

D. Materials List
   The CONTRACTOR shall submit, along with shop drawings, a materials list, which shall include full information regarding all components of the watermain. Materials of construction shall be presented in the listing.

E. Other Submittals
   1. Prior to installation of the proposed watermain, the CONTRACTOR shall furnish the required number of the manufacturer’s Operation and Maintenance Manual for each item.
2. The CONTRACTOR shall submit certificates of compliance with the applicable referenced standards.

3. A tabulated layout schedule.

4. Detailed procedure, schedules and list of materials for interconnection sequence.

5. Furnish delivery tickets indicating the pipe manufacturer, pipe type and class, identifying that the pipe was new and from a manufacturer that has been submitted and approved.

F. Certificate

1. Submit certificate of compliance with NSF/ANSI Standard 61 for all products under this section, including interior coatings, by an independent, authorized laboratory.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

G. During delivery and handling, all materials shall be braced and protected from any distortion or damage in accordance with the manufacturer’s requirements; any such distortion or damage shall be basis for rejection of the materials.

H. Equipment used for unloading shall be covered with wood or rubber to avoid damage to the exterior of the pipe, fittings and accessories. Do not drop or roll materials off trucks.

I. The materials shall be inspected before and after unloading. Materials that are found to be cracked, chipped, gouged, dented, or otherwise damaged shall not be accepted.

J. Interiors of pipe, fittings and specials shall be kept free from dirt and foreign matter.

K. Store pipe and fittings on heavy wood blocking or platforms so they are not in contact with the ground.

L. Pipe, fittings, and specials shall be unloaded opposite to or as close to the place where they are to be used as is practical to avoid unnecessary handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General

1. All products, including interior coatings, shall be suitable for use in a potable water system.

2. All products, including wetted parts, shall be certified to meet NSF/ANSI Standard 61.
B. Pipe

Materials for the piping, joints and fittings shall be as specified in other related sections or as shown in the pipe schedule or on the Contract Drawings.

1. Pipe and appurtenances shall comply with the applicable standards for its type of material.

2. All pipes, fittings, valves, hydrants, specials, and accessories must be new materials in first-class condition. Used or recycled materials shall not be allowed, regardless of condition.

3. Piping for hydrant branches shall only be Class 53 ductile iron.

4. Piping within casing pipes (except for tree bores) and beneath pavement shall be either ductile iron pipe or prestressed concrete cylinder pipe as shown and as specified.

5. Piping in non-paved areas shall be either ductile iron pipe, prestressed concrete cylinder pipe, or PVC as shown and as specified.

C. Joints

Type of joints shall be as specified in other related Sections or as shown in the pipe schedule or as on the Contract Drawings.

D. Detectable Pipe Marking Tape

Detectable pipe marking tape as manufactured by C. H. Hanson Products or approved equal shall be installed above all new watermain.

1. Tape shall be 3 inches wide consisting of two (2) exterior plies of polyethylene with an aluminum alloy foil core.

2. Tape shall be blue color and labeled: “WATER” in black letters.

3. Tape shall have a minimum thickness of 5 mils as per ASTM D2103.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Blocking will not be permitted under pipe, except where the pipe is to be laid with concrete cradle or encasement.

2. Pipe shall be installed on a layer of select material as shown on the Drawings to provide an acceptable bedding. The top of this layer shall then be considered the bottom of the trench.

3. Pipe shall not be laid on bedrock without appropriate bedding stone.
4. No pipe shall be laid upon a foundation in which frost exists; or when there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.

5. Bell holes shall be dug in the bottom of the trench to allow the pipe to have a firm bedding along the entire length of the pipe.

6. Temporary watertight bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris, or water.

7. Precautions shall be taken to prevent the flotation of pipe in the event of water entering the trench.

B. Location and Grade

1. Watermain and appurtenances shall be located as shown on the Contract Drawings or as directed and as established from the control survey in accordance with the General Requirements.

2. The alignment and grades shall be determined and maintained by a method acceptable to the ENGINEER.

3. Pipe shall be installed in straight horizontal trenches. “Snaking” of pipe by bending sections horizontally shall not be allowed.

C. Joints

1. Joints shall be assembled using gaskets, lubricants and solvents as furnished by the pipe manufacturer and in accordance with the manufacturer’s recommendations.

2. Joint deflection shall not exceed 50% of manufacturer’s recommendations.

3. For watermains:
   a. Bedding shall be deposited and tamped in 6-inch layers to the centerline of the pipe or to 6 inches above the pipe in paved or traveled areas.
   b. Native material placed above the centerline of the pipe shall be deposited in such a manner as to not damage the pipe. Native material shall be suitable for backfill above the centerline of the pipe provided the materials are 2 inches in size or less. Native materials shall be suitable for backfill 6 inches above the pipe in non-paved areas provided the materials are 2 to 4 inches in size, but bedding is required to 6 inches above the pipe. Native materials greater than 4 inches are unacceptable for backfill.
D. Thrust Restraints

Thrust restraints for watermains shall be accomplished by the use of mechanical restraints. Restraints shall be in the form of retainer glands; ductile iron locking segments with spigot weldment; or anchors of the size and type specified or as required by the pressure and stability of the supporting surface.

1. Thrust restraints shall be installed at all changes in direction, changes in size, dead ends or other locations where shown or directed.

2. Valves shall be treated as a bulkhead condition and pipe joints shall be restrained on both sides of the valve.

3. Cast in place concrete used for thrust restraints shall have developed the required strength prior to testing of the watermain.

4. When approved for use by ENGINEER, tie rods and nuts for thrust restraints shall be of high tensile steel and shall have a minimum yield strength of 70,000 psi.
   a. Tie rods and nuts installed underground shall be coated with two coats of coal tar pitch preservative coating after installation.
   b. Oil, grease, paint, or any coating which requires drying will not be acceptable.

5. All fire hydrant branches from the mainline tee to and including valve and hydrant shall be restrained.

6. All piping installed for interconnections shall be restrained.

7. All piping installed within casing pipes shall be restrained for the full length of the pipe installed within the casing pipe.

8. All piping installed within the limits of creek crossings shall be restrained for the full length of the creek crossing limits.

E. Service Connections

1. Connections to in-service pressure watermains shall be in accordance to the construction drawings.

F. Magnetic Pipe Marker

1. Magnetic pipe marker tape shall be placed above all new watermains as shown on the Drawings.

2. Magnetic pipe marker tape shall be tied to watermain valve boxes.

3. Splices, where needed, shall be made in accordance with manufacturer’s recommendations.
4. At completion of the project and before final payment is made, the CONTRACTOR shall test the entire length of the pipe using pipe locating equipment. Tests shall be made only in the present of the ENGINEER. Any section of tape not continuous or that is undetectable shall be removed and replaced at the CONTRACTOR’S expense.

3.2 CUTTING AND SPECIAL HANDLING

G. Field cuts of pipes shall be in accordance with the manufacturer’s instructions.

H. Where a pipe requires special handling or installation it shall be in accordance with the applicable referenced standard.

3.3 INTERCONNECTIONS

A. Perform interconnections as shown on the Contract Drawings.

3.9 GENERAL

A. Install watermain, fittings, and accessories in accordance with applicable sections; as shown on the drawings; and, as specified, required, or directed.

B. Water Service Installations

1. Existing service lines shall be maintained until such time as the proposed watermain has been installed, tested, and disinfected, and approval to place the watermain into service has been obtained. Existing services may then be transferred to the new watermain.

2. New water service installations shall be installed by boring or jacking method under existing roads and pavements. Open-cut of water services across roads will not be allowed.

3. Use tapping machines and equipment compatible with corporation stops and service saddles specified. Use tools and cutting equipment, which minimizes the amount of PVC shavings and remove shavings during tapping; retain coupon, and reduce stress during tapping. Single fluted cutters or twist drills shall not be used for tapping PVC piping.

4. Service locations shown on the drawings are shown schematically only. The actual service locations shall be determined by ENGINEER and CONTRACTOR in the field.

5. For additional information relating to water services, refer to the Drawings.

C. Tapping Watermain.

1. Wet tap connections to existing watermains shall be as shown on the drawings.
2. The person or firm who will be performing the watermain tap shall be acceptable to the Authority.

3. Prior to ordering the tapping sleeve, the CONTRACTOR shall excavate a test pit to the depth required and expose the main to be taped to accurately measure the outside diameter of the main. No tapping sleeve shall be ordered until this information has been obtained.

4. Tapping sleeves shall be suitable for use with the existing pipe to be tapped. Tapping sleeve shall be compatible with the tapping valve furnished.

5. Thrust blocks shall be constructed behind the wet tap connection as shown on the drawings and specified herein.

6. After each tap has been completed, the CONTRACTOR shall keep the tapping area uncovered for a minimum period of one (1) hour to determine if any leakage is occurring. If any leakage has occurred, the tap shall be made watertight in a manner approved by the ENGINEER.

7. A full pipe coupon shall be retained as a result of the tapping operation.

8. The valves shall be kept closed until approval from the ENGINEER is given to open the valve.

D. Discrepancies

1. If discrepancies occur between the Drawings and field conditions, the CONTRACTOR shall notify the ENGINEER immediately.

2. The CONTRACTOR shall not proceed with the installation in areas of discrepancy until said discrepancy is resolved.

END OF SECTION
PART 1 – GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish, install, and test all specified piping together with all fittings and appurtenances as shown together with all fittings and appurtenances as shown on the Contract Drawings and as required for a complete installation.

The drawings were prepared to show the minimum number of flanged connections. The contractor can furnish and install additional flanges. Shop fabricated pipe spools can be furnished with flanged connections to facilitate final connections without the need for field welding.

Furnish and install connections, including adapters as required, to existing pipelines and all specials required to connect pipelines of dissimilar materials included under this and related sections. Also included under this and related sections are all required closure pieces.

1.2 QUALITY ASSURANCE

A. General

1. The pipe and fittings covered by these specifications shall be furnished by fully qualified manufacturers experienced in the fabrication, casting and manufacture of the pipe materials specified herein. The pipe and fittings shall be designed, fabricated and installed in accordance with the best practice of the trade and the standards specified herein.

B. Field Tests

1. Shall be performed as specified herein and in accordance with the General Conditions and Division 1.

C. Letters of Compliance

1. In accordance with the submittals paragraph, the contractor shall obtain and submit certified statements that the pipe, joints, fittings and linings comply with the requirements of the standards specified herein.

SUBMITTALS

A. Shop Drawings

1. Each submittal shall be complete in all aspects incorporating all information and data listed herein and all additional information required to evaluate the proposed piping material’s compliance with the contract documents. Partial or incomplete submissions shall be returned to the Contractor disapproved without review.

Data to be submitted shall include but not be limited to:

a. Catalog data consisting of specifications, illustrations and a parts schedule that identified the illustrations and a parts schedule that identifies the materials to be used for the various piping components and accessories. The illustrations shall be in sufficient detail to serve as a guide for assembly and disassembly.
b. Complete layout and installation drawings with clearly marked dimensions. The contractor shall verify all necessary dimensions to establish accurate layouts of the piping to be shown on the shop drawings. Scale and size of the drawings shall conform to the specifications in Division 1. Piece numbers shall be marked on the drawings which shall be coordinated with the tabulated pipe layout schedule.

c. Pipe hangers and support layout and drawings including schedule. Pipe hanger and support design analysis prepared and stamped by a professional engineer who is licensed in the State of New York and who is recognized as expert in piping and support systems.

d. Design calculations where specified.

e. All welds to be made in the field shall be prominently and individually marked on the shop drawing with a note, such as “Field Weld” and the pertinent weld data in accordance with AWS Standards.

B. Certified Letters of Compliance

1. The Contractor shall obtain from the manufacturer and submit to the Engineer copies of certified letters of compliance in accordance with the General Conditions.

SCHEDULE OF PIPING MATERIALS

A. A schedule of piping materials is presented at the end of this section. The schedule indicates service, material, wall thickness, joint type, coatings, and linings.

HANDLING AND DISTRIBUTING PIPE

A. Special care in handling shall be exercised during delivery, distribution and storage of pipe to avoid damage and setting up stresses. Damaged pipe will be rejected and shall be replaced at the contractor’s expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.

PART 2 - MATERIALS

2.1 GENERAL

A. All pipe and fittings shall be marked with the manufacturer’s name or trademark, size, class, and the date of manufacture in accordance with the standards specified herein.

B. All bolts and nuts shall be hexagonal conforming to ANSI B18.2 and shall be Type 315 Stainless Steel except where noted.

C. All pipes and pipe appurtenances must be made in the USA.

D. Raised Face Flanges.

No raised face flanges in conformance with ANSI B16.5 Class 150 shall be acceptable. All raised faces shall be milled flat. The only exceptions to this rule are ANSI B16.5 Class 300-pound flanges where connected to equipment or valves that have 250-pound rated flanges.

2.2 STAINLESS STEEL PIPE AND FITTINGS FOR LOW PRESSURE AIR SERVICE
A. General

1. For air piping whose nominal pipe sizes range from three (3) inches to forty-eight (48) inches, shall be fabricated in accordance with ASTM A778 from Type 304L stainless steel for exposed installation and Type 316L for submerged installation as specified in the piping schedule.

2. One length of fabricated piping shall be subjected to a hydrostatic test as specified in ASTM A530 or a pressure test as specified in ASTM A409. The test pressure shall be fifty (50) psi for either test. The pipe manufacturer shall certify and submit test procedure, pressure, results and corrective actions taken. Should the test section fail, then all fabricated lengths shall be successfully tested and certified (submit results) by the manufacturer prior to shipment.

3. All welds shall be free from burrs, snags or rough projections.

4. Stainless steel piping and fittings shall be shop fabricated to the maximum extent possible to eliminate the need for field welding.

Shop fabricated pipe spools shall be furnished with flanged joints and combination of field adapters to make final pipeline connections.

5. Field adapters with mechanical couplings may be used for final make-up sections to avoid any welding in the field. Adapters may be plain end sections with mechanical couplings. Mechanical couplings shall be split type furnished with synthetic rubber gaskets that are suitable for 250°F air service. Couplings shall be Type 316L stainless steel with a minimum wall thickness of 0.120 inches. Bolts and nuts for couplings shall be ASTM A276, Type 316 stainless steel. Additional guided supports shall be furnished on both sides of couplings to provide lateral restraint. Mechanical couplings shall be manufactured by Brice Industries, Inc., P.O. Box 80793, Atlanta, Georgia 30366 or approved equal.

B. Wall Thickness

1. Shall be schedule 10S for nominal pipe sizes up to twenty-four (24) inches. Above diameters of 24 inches, wall thickness shall be 0.25 inches. The wall thicknesses for the above schedules shall conform to ANSI B36.19.

2. Deviations from the above wall thicknesses shall be noted in the piping schedule.

C. Joints

1. Shall be butt welded, mechanically coupled (see paragraph A.5), flanged or grooved. Unless otherwise shown on the contract drawings. No welding in the field shall be permitted.

2. Welding practices for joints shall conform to those specified for the manufacture of the pipe and fittings in ASTM A774 and A778, applicable sections of AWWA C206 and the specifications contained herein.

3. Flanged joints shall be raised face type with welded stub ends. Raised faces shall be milled flat. Stub ends shall be Type A and comply with MSS SP-43 dimensions as applicable. Flanges shall be Type 316L.

Full face gaskets shall be furnished made of synthetic rubber and able to withstand temperatures of 250°F.

Bolt circle and bolt hole patterns shall conform to ANSI B16.5 Class 150. Bolts and nuts used to make up the joints shall be hexagonal and conform to ANSI B18.2.
Gaskets shall be rated for 250°F service. All hardware (nuts, bolts and washers) for flanged joints for pipe shall be 316 stainless steel.

4. Alternatively, flanged pipe ends shall be made up of Type 304L or 316L stainless steel slip-on type rolled angle face rings and galvanized ductile iron back-up flanges drilled to ANSI 16.1, Class 125 standard. The angle face ring thickness shall be equal to or greater than the wall of the pipe or fitting to which it is welded and it shall be continuously welded on both sides to the pipe or fitting. The angle leg shall not interfere with the flange bolt holes. The back up flanges shall be supplied per ASTM A536 with the following nominal thicknesses.

<table>
<thead>
<tr>
<th>Nominal Pipe Size (in.)</th>
<th>Flange Thickness (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/2 – 3</td>
<td>½</td>
</tr>
<tr>
<td>4.0</td>
<td>9/16</td>
</tr>
<tr>
<td>6 – 10</td>
<td>5/8</td>
</tr>
<tr>
<td>12 – 16</td>
<td>3/4</td>
</tr>
<tr>
<td>18 – 20</td>
<td>7/8</td>
</tr>
<tr>
<td>24 – 30</td>
<td>1</td>
</tr>
<tr>
<td>36</td>
<td>1-1/8</td>
</tr>
<tr>
<td>42</td>
<td>1-1/4</td>
</tr>
<tr>
<td>48</td>
<td>1-3/8</td>
</tr>
<tr>
<td>54</td>
<td>1-3/8</td>
</tr>
<tr>
<td>60</td>
<td>1-1/2</td>
</tr>
</tbody>
</table>

5. Mechanical couplings shall be stainless steel or equal or superior alloy and wall thickness as the pipe and will be Depend-O-Lok type as manufactured by Brico or approved equal. Couplings will be Fixed – FxF, Expansion – Exe, or fixed by expansion – FxE as determined by the piping and supports shop drawing sand design analysis. The pipe shall be plain end with external weld beads ground smooth and with stainless steel restraining rings shop welded to the piping for fixed type couplings.

D. Fittings

1. Shall be fabricated from stainless steel in conformance with ASTM A774 of the same wall thickness and material as specified for the pipe in the connecting pipe schedule.

2. Long radius elbows up to 24" diameter shall be smoothflow; i.e., centerline to end of elbow equals 1.5 times the nominal pipe size. All short radius, special radius, and reducing elbows and long radius elbows greater than 24 inch diameter shall be of mitered construction with at least five miter sections for 90 degree bends, and two mitered sections for 30 degree and small bends. Reducers shall be straight tapered, cone type. Tees, crosses, laterals and wyes shall be shop fabricated from pipe.

E. Specialties

1. Pipe and fittings shall be pickled prior to shipment. All residues of the pickling solution shall be neutralized after pickling.
2.3 CARBON STEEL PIPE AND FITTINGS

A. General

1. Shall conform to ASTM A53 Type S, Grade B for nominal pipe sizes two (2) inches to twenty-four (24) inches.

2. Shall conform to AWWA C200 for nominal pipe size twenty-four (24) inches and larger. ASTM specified by AWWA C200.

3. Shall conform to ASTM A106, for nominal pipe sizes less than two (2) inches.

B. Wall Thickness

1. Shall be the minimum specified in the table below.

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inches)</th>
<th>Schedule or Wall Thickness Weight Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 and less</td>
<td>40</td>
</tr>
<tr>
<td>14 and greater</td>
<td>0.375 inches</td>
</tr>
</tbody>
</table>

C. Joints

1. Shall be flanged, welded, coupled or threaded as specified in the pipe schedule contained herein.

2. The pipe ends shall be prepared for the joining system specified for the pipe. Ends for welding shall be beveled in accordance with ANSI B31.8 at 30 degrees with a maximum of 37-1/2 degrees.

3. Flanged joints for nominal pipe sizes over four (4) inches shall be made up using flanges conforming to AWWA C207. The flanges can be either hub or ring slip on type. Flanges shall be Class B for pipes with test and working pressures below 86 psi and Class D for pipes with test and working pressures below 150 psi and above 86 psi. The flanges shall have bolt circle and bolt hole patterns conforming to ANSI B16.1 Class 125 and shall be flat faced. Raised faces shall be milled flat. Bolts and nuts used to make up the joint shall conform to ANSI B182. Low strength bolting materials as specified in ANSI B16.5 shall be used. Gaskets shall be full face and made of natural or synthetic elastomers in accordance with ANSI B16.21 with a temperature rating of 250° F. The appropriate AWWA class. Welding neck flanges conforming to ANSI B16.5 shall be acceptable.

For three (3) and four (4) inch pipes, flanges shall conform to ANSI B16.5 class 150 flanges which shall be milled flat. Where specified or for working pressures in excess of 200 psi, ANSI B16.5 class 300-pound flanges shall be used. Raised face flanges are permitted.
4. Welding of pipe joints where shown, specified, permitted or required shall meet the requirements of the American Welding Society and ANSI B31.1 “Code for Pressure Piping”, unless otherwise specified. Pipe and fittings with wall thickness of 3/16 inch and larger shall have ends beveled for welding. The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping. Welding shall be “fixed position” type, continuous around the joint and shall be completed without interruption. Welds shall be of the single vee butt type of sound weld metal thoroughly fused into the ends of the pipe and into the bottom of the vee. Welds shall be free from cold spots, pin holes, oxide inclusions or other defects. Filler metal for welding shall be of the same composition as the base metal. All welds shall be free from burrs, snags or rough projections.

5. Threaded joints shall be used only for nominal pipe sizes below three (3) inches. Pipe threads shall conform to ANSI B2.1. All threads shall be clean, machine cut, and all pipes shall be reamed before erection. Each length of pipe as erected shall be up ended and rapped to dislodge dirt and scale. Screwed joints shall be made up with good quality thread compound and applied to the male thread only. After having been set up, a joint must not be backed off unless the joint is completely broken, the threads cleaned, and new compound applied. All joints shall be air tight.

6. Mechanical couplings as specified in subsection 2.02C.5 may be furnished for straight runs of carbon steel piping for services so specified in the piping schedule. Couplings shall however, be minimum 3/4 inch thick and made of type 304L stainless steel and sized for carbon steel.

D Fittings

1. For nominal pipe sizes less than three (3) inches or as specified in the pipe schedule class 150 lb. banded malleable iron threaded fittings shall be provided for carbon steel or galvanizing steel piping. Fittings shall conform to ANSI B16.3.

2. For flanged and welded joints, shall conform to the dimensional requirements of ANSI B16.5 standard for pipe flanges and flanged fittings or ANSI B16.9 factory-made wrought steel butt welding fittings.

Fittings fabricated in conformance with ANSI B16.9 shall be of the same wall thickness as specified for the pipe and shall have tangents for slip on type flanges.

3. Manifold fittings shall be fabricated as dimensioned on the plans.

4. Bell (concentric) type reducers shall not be acceptable; only cone type reducers shall be used.

E. Coatings and Linings for Pipe and Fittings

1. Shall be as specified in the pipe schedule contained herein.

2. The interior of carbon steel piping for air service shall be shop sand blasted and painted with a coal tar epoxy coating system as specified in Section 09800, Special Coatings.
3. A coat of rust inhibiting primer in conformance with Section 9800 shall be applied before shipment to the exterior of the pipe as specified.

4. Galvanized pipe where specified shall be coated with zinc conforming to ASTM B6 by the hot dip process. Pipe interiors and exteriors shall be hot dipped galvanized. The weight of coating shall be 1.8 oz/s.f. for both interior and exterior surfaces. The testing procedure shall be as outlined in ASTM A53 for galvanized pipe.

Piping which shall be covered with insulation shall have its exterior surfaces galvanized in accordance with the standards specified herein.

5. The pipe and fittings shall be cement mortar lined to the standard thickness in accordance with AWWA C205 as specified in the pipe schedule. The lining shall be shop applied. A seal coat of asphaltic material shall be applied as specified in ANSI A21.4 (AWWA C104).

2.4 DUCTILE IRON PIPE AND FITTINGS

A. General

1. Shall be centrifugally cast in metal molds or sand lined molds in accordance with ANSI A21.51 (AWWA C151) of grade 60-42-10 ductile iron. The above standard covers ductile iron pipe with nominal pipe sizes from three (3) inches up to and including fifty four (54) inches in diameter.

B. Wall Thickness

1. Shall be minimum Class 53 for flanged piping in all cases or as specified in the pipe schedule if indicated in the schedule to be greater. ANSI A21.15 (AWWA Cl 15) requires this class as a minimum for use with threaded flanges.

2. Shall be in accordance with AWWA C606 when grooved couplings are used. The pipe classes shall be as follows:

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inches)</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 16</td>
<td>53</td>
</tr>
<tr>
<td>18</td>
<td>54</td>
</tr>
<tr>
<td>20</td>
<td>55</td>
</tr>
<tr>
<td>24</td>
<td>56</td>
</tr>
</tbody>
</table>

C. Joints

1. Joints for interior piping and fittings shall be flanged type. Flanged joints shall be in accordance with ANSI A21.15 (AWWA C115). Bolt circle and bolt hole patterns shall conform to ANSI B16.1 class 125 flanges and ANSI B16.5 Class 150 flanges as required to mate and join piping appurtenances. Bolts and nuts used to make up the joints shall conform to ANSI B18.2 Gaskets shall be ring type and made of natural or synthetic
elastomers in accordance with ANSI B16.21 suitable for the service characteristics especially chemical compatibility and temperature.

No raised face flanges shall be used. The raised faces shall be milled flat.

2. Grooved end joints shall be combinations of flexible and rigid type in accordance with AWWA C606 and as specified in paragraph 2.08 contained hereinafter.

3. A number of flexible grooved end joints will be furnished and installed to allow for expansion and contraction of the piping system based upon a differential temperature of 200° F. Flexible joints shall comply with requirements of AWWA C606. Ductile iron piping shall be radius grooved. Grooving of piping and fittings shall be accomplished by the piping manufacturer or in piping shop.

D. Fittings

1. Shall be manufactured in accordance with ANSI A21.10 (AWWA C110) for nominal pipe sizes three (3) inches to forty-eight (48) inches. For pipe sizes three (3) inches to sixteen (16) inches, fittings conforming to ANSI A21.53 (AWWA C153) may be used.

2. For fittings which are not specifically covered by ANSI A21.10 (AWWA C110) the standards contained in ANSI B16.42 shall apply.

3. Shall be manufactured of grade 70-50-05 ductile iron.

4. Shall have a rated working pressure of 250 psi for nominal pipe sizes of three (3) inches to twenty-four (24) inches and a minimum of 150 psi for nominal pipe sizes of thirty (30) inches to forty-eight (48) inches.

5. Blind, filler, companion, and reducing flanges shall conform to ANSI B16.1.

6. Gray iron fittings which conform to the specifications contained herein may be used with ductile iron pipe providing the minimum working pressure of the fittings meets or exceeds the rating of the pipe.

7. Fittings for grooved and piping shall be ductile iron ASTM A536, dimensionally compatible with piping to be furnished. Fittings’ length shall comply with ANSI A21.10.

8. Grooved fittings shall be radius grooved for rigid connections.

9. Fittings for sludge shall be long radius.

E. Coatings and Linings for Pipe and Fittings

1. Coatings

A coal tar epoxy or other epoxy coating of a minimum dry thickness of 16 mils thick dry shall be applied to the exterior wall of the pipe and fittings in accordance with Section 9900, Painting. All submerged piping and fittings shall be coated with coal tar epoxy or
other epoxy. All interior and exposed piping shall be prepared, primed and painted per Section 9900, Painting.

2. Cement Lining

The pipe and fittings shall be cement mortar lined to twice the standard thickness in accordance with ANSI A21.4 (AWWA C104) except as specified in the pipe schedule noted herein, a seal coat of asphaltic material in accordance with ANSI A21.4 (AWWA C104) shall be applied to the mortar lining or where specified in the schedule.

3. Polyethylene Lining:

   a. Shall utilize a virgin polyethylene conforming to ASTM D1248 compounded with carbon black or other ultraviolet inhibitor. Pipe interior shall be blasted to SSPC-SP6 commercial sand blast standards.

   b. Shall be fused to the interior of the pipe by heat forming a tightly bonded lining.

   c. Shall be 40 mils thick and smooth finish. Minimum thickness in any one location shall be 30 mils.

   d. Shall extend the entire length of the pipe.

4. Special pipe linings shall be used when specified in the pipe schedule contained herein.

   Where specified for transition or interim piping, mechanical joints shall comply with the requirements of ANSI A21.11 (AWWA C111).

2.5 CAST IRON SOIL PIPE AND FITTINGS

A. Soil Pipe and Fittings

Soil pipe and fittings shall be used for buried and embedded process drain not under pressure lines where shown on the Contract Drawings and shall be “extra heavy” cast iron hub and spigot soil pipe with lead one-piece push-on compression gasket. Pipe and fittings shall conform to ASTM A74. Cleanouts shall be provided at all changes in direction and at ends of lines. All traps shall be provided with a cleanout so placed that the interior of the trap is accessible for cleaning.

B. No-Hub Pipe Fittings

No-hub pipe fittings shall be used for process floor drain and roof drain lines and may be used for vent piping. The pipe and fittings shall be cast iron, with neoprene sleeve gasket and stainless-steel retaining clamp for the sleeve gaskets, all in conformance with Cast Iron Pipe Institute Standard 301. Cleanouts shall be provided at all changes in direction and at ends of lines.
2.6 COPPER PIPE AND FITTINGS

A. General
   1. Shall be type K seamless water tube conforming to ASTM B88, seamless, for nominal pipe sizes two (2) inches and smaller.

B. Wall Thickness
   2. Shall be as specified for the size of pipe in the standards.

C. Joints
   1. Shall be solder type. Solder shall consist of 95% tin and 5% antimony. Soldering shall be in conformance with Section 3 of the C.A.B.R.A. Copper Tube Handbook.
   2. Where connecting to threaded valves, adaptors shall be used.

D. Fittings
   1. Shall be wrought copper conforming to ANSI B16.22 or cast copper alloy conforming to ANSI B16.18.

2.7 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS

A. General
   1. Shall conform to ASTM D1785 and shall be made form a 12454B compound which is a Type 1, Grade 1 plastic as defined by ASTM D1784. Rerun or reclaimed materials will not be acceptable.
   2. Pipe to be used for potable water applications shall comply with the National Sanitation Foundation Standard No. 14 and shall have markings on the pipe to indicate that it has been tested and is in compliance.

B. Wall Thickness
   1. Shall be as specified for the size of pipe and schedule noted in the pipe schedule contained herein.
   2. Shall be a minimum of Schedule 80 for pipes not listed in the schedule contained herein.

C. Joints
   3. Shall be socket welded for nominal pipe sizes up to four (4) inches and socket welded flanges for nominal pipe sizes for four (4) inches and larger or as noted in the pipe schedule contained herein.
   4. Threaded joints shall not be used.
5. Socket type joints shall be made up in accordance with ASTM D2564. The cement shall have a minimum viscosity of 200 cps.

6. Where flanges are to be used, full faced vinyl gaskets shall be used.

D. Fittings

1. Socket type pipe fittings for schedule 40 pipe shall conform to ASTM D2466.

2. Socket type pipe fittings for schedule 80 pipe shall conform to ASTM D2467.

3. Fittings shall have the same schedule designation, joint type and be made of the same PVC compound as the connecting pipe.

2.8 COUPLINGS

A. General

1. Couplings required in the work are designated on the Contract Drawings as flexible or flanged coupling adapters. All couplings furnished under this Section shall receive a shop prime coat of paint in compliance with the requirements of Section 09900, Painting. The interior surface of pipe and couplings exposed to the pipe contents at a coupling joint shall be painted as specified in Section 09900 for submerged ferrous metal surfaces.

2. Pipe couplings shall be designed to safety withstand the operating pressure of the lines on which they are installed.

3. Gaskets used for jointing systems on compressed air discharge piping shall be EPDM rubber or equal suitable for 280°F temperature air. Coupling gaskets for other services shall comply with ANSI/AWWA C219 and shall be fabricated of materials compatible with sewage and sludge.

4. All buried couplings shall be given a heavy coat of bitumastic paint as specified in Section 09900 after the joints are completed.

5. Pipe couplings are indicated on the contract drawings where required. Additional couplings may be necessary for a proper pipe installation. The contractor shall show these couplings on his detailed drawings and laying schedules.

B. Flexible Couplings (FC)

1. All applications with either steel or ductile iron pipe shall be Style 38 as manufactured by Dresser Manufacturing Division or equivalent models by Smith Blair, Rockwell Industries or equal and shall conform to ANSI/AWWA C219.

All applications with stainless steel pipe shall be fabricated of 315 stainless steel for all components except the gaskets.
Gasket material shall be compatible with the service application especially with respect to temperature requirements and chemical compatibility.

2. The interior of the middle ring other than stainless steel rings shall be painted with two coats of asphaltic coating suitable for the service intended. The middle ring shall not have a pipe stop.

3. Shall be placed on all pipes leaving concrete encasements.

4. For applications where 316 stainless steel components are required, harnessing materials and hardware shall be 316 stainless steel.

C. Flanged Couplings Adapters (FCA)

1. All flanged coupling adapters, except as shown on the Contract Drawings or as directed by the engineer shall be locking type flanged coupling adapters. One end of the adapter shall be flanged suitable for connecting to ANSI B16.1 and B16.5 flanges. The adapter body shall be ASTM A126 Class B cast iron and furnished with corrosion resistant trackhead bolts and hexagonal nuts. Flanged coupling adapters for ductile iron piping shall be Dresser Style 12 or Rockwell International Style 912 for piping 4 to 12 inches and Dresser Style 128 or Rockwell International Style 913 for piping greater than 12 inches. Flanged coupling adapters for steel piping shall be Dresser Style 128 or Rockwell International Style 913. The adapters shall conform to ANSI/AWWA C219.

2. Flanged coupling adapters shall be installed where shown on the contract drawings and where required to correct misalignment, to allow penetration of wall sleeves to connect to existing piping and permit dismantling of equipment and valves.

3. Flanged coupling adapters through 12-inch nominal diameter may be harnessed by means of anchor studs or as shown on the contract drawings. Anchor studs shall be furnished to accept and be supplied with minimum of four anchor studs. Harness shall be as designed and recommended by the manufacturer.

4. The anchor studs shall be installed as follows:
   a. Follow manufacturer’s instructions for installing the flanged coupling adapters.
   b. Screw a standard k2 inch pipe nipple into the anchor stud boss.
   c. Drill a 5/8-inch hole completely through the pipe thickness using the k2 inch pipe nipple as a pilot.
   d. Remove the 1/2 inch nipple and install the 1/2 inch anchor stud.

5. Flanged coupling adapters larger than 12 inches nominal diameter shall be locked by means of harness clamps or threaded rods and thrust plates.
The harness clamp shall consist of split ring which shall be clamped to the pipe by a minimum of four (4) high strength steel bolts. The clamp shall be of sufficient width to prevent overstressing of the pipe when the clamp is drawn up to design tightness. The harness clamp shall be tied to the flanged coupling adapter by means of a minimum of four (4) tie bolts which pass through lugs welded to the flanged coupling adapter and harness clamp. A total of eight lugs shall be provided four on the harness clamp and/or flanged adapter. The threaded tie bolts shall be of high strength ASTM A242 steel furnished with hexagonal nuts.

Dimensions, sizes, spacing and materials and fastenings for harness clamps, lugs, threaded tie bolts, nuts, washers and other necessary items shall conform to the standards of Dresser Industries; Smith Blair; or equal and as approved by the engineer for the pipe size test and operating pressure of the pipe. A minimum of four tie bolts shall be furnished for each flanged coupling.

D. Expansion Joints (Arch Type)

1. For air service shall be single arch Style No. 400 as manufactured by Mercer Rubber Company or an equivalent model by Metraflex Co., General Rubber or equal. The coupling shall be rated for a minimum working pressure of 30 psig. The elastomer shall be Nordel or equal for continuous operating temperature of 350°F.

2. All expansion joints shall have a split and beveled stainless-steel retaining rings. Stainless steel washers shall be provided at the point where the rings are split. Bolt holes and bolt circle at the point where the rings are split. Bolt holes and bolt circle patterns shall conform to the mating flange patterns as specified in the piping paragraph.

3. Control units shall be provided and installed with all expansion joint type couplings. The control unit shall be supplied by the coupling manufacturer. Control units shall allow expansion joints to expand and contract.

4. For stainless steel air piping shown with couplings; control units, plates, retaining and spacer rings, washers, bolts and nuts shall also be 316 stainless steel.

5. A Hypalon coating shall be applied to the exterior of the elastomers.

E. Grooved Couplings

1. Shall be in accordance with AWWA C606.

2. For steel pipe with nominal sizes ranging from two (2) inches to twelve (12) inches shall be style 77 or 07 by Victaulic or equal. This coupling and grooving dimension shall provide flexible or rigid joints based upon the contractor’s selected layout of the piping hanger and support system.

3. For ductile iron pipe for nominal pipe sizes ranging for three (3) inches to twenty-four (24) inches shall be style 31 by Victaulic, or equivalent models by Aeroquip or equal. The joint grooving dimensions for straight runs of pipe shall be in conformance to the flexible joint specifications. For fittings joints shall be grooved for rigid connections. The gasket shall be a flush seal type.
4. Flexible grooved joints will be required to allow for expansion of the piping. A sufficient amount of flexible joints shall be installed to accommodate expansion resulting from a differential temperature of 100°F. Otherwise a Flexonics expansion joint shall be installed to augment the piping system to sustain expansion and contraction from a differential temperature of 200°F.

5. Fittings for grooved end piping shall be ductile iron dimensionally compatible with the piping that is furnished.

6. Make-up flanges and suitable adapters shall be furnished to connect to equipment and valves that are manufactured with flanges. Flanges shall be compatible with equipment and valves.

7. Style 07 Victaulic or equal couplings shall be used for rigid grooved steel pipe as an alternative to HP-70 style 77 Victaulic or equal shall be used for flexible grooved steel pipe.

8. Gaskets for grooved end couplings shall be EPDM rubber for use in hot water service. Continuous service temperature rating of gaskets shall be 230°F minimum.

2.9 UNIONS

A. For ductile iron, carbon steel and gray cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39 with ground joints.

2.10 FLEXIBLE PROCESS TUBING AND CONNECTORS

A. Tygon Tubing

1. Shall be Tygon B-44-4X Inner braided tubing or Tygon R3603 vacuum tubing as specified in the pipe schedule.

B. Reinforced Polyvinylchloride Tubing

1. Shall be NT-80 clear flexible tubing with polyester cord reinforcing rated for a minimum burst strength of 200 psi.

C. Tubing Connectors

1. Shall be male hose connector with sleeve which allows the connection to develop 100% of the tubing’s working pressure. The connector shall be manufactured by Swagelock, Parker or equal.
2.11 INSULATION

A. General

1. Pipelines shall be insulated as called for in the pipe schedule. The piping shall be cleaned, tested and painted (except stainless steel piping) as specified prior to the application of the insulation. All surfaces of pipe jacketing shall be smooth and even. All sectional pipe covering shall be removable and stopped and beveled off a sufficient distance from all flanges and screwed joints to permit easy removal of flange bolts and screwed joints. All insulation shall be products of Certainteed 500° F Snap-n Fiber Glass, Micro Lok 650 or equal.

2. Fittings and valves shall be insulated with molded or mitered segments of same thickness, type and finish as adjoining pipe covering. Flanged and screwed joints shall be insulated with sectional or block insulation, removable and replaceable. The flanged and screwed joint insulation shall be filled with a cement as recommended by the manufacturer.

3. Piping insulation shall be Type A or B, as indicated in the piping schedule.

4. Type A and B piping insulation systems shall have a composite (insulation jacket and adhesive) Fire and smoke hazard rating as tested by ASTM E84 not exceeding:

   Flame Spread 25
   Smoke Developed 50

5. Type A and B piping insulation shall have attached a vapor barrier consisting of a laminate of high-density Kraft paper bonded to aluminum foil reinforced with fiberglass yarn.

6. Insulation and pipe supports – For nominal pipe sizes of up to 3 inches, the insulation shall pass through the hanger uninterrupted. For larger pipe sizes, the insulation may be fitted over the pipe and hanger, and the hanger and rod wrapped with foil-faced blanket insulation and vapor sealed for a minimum distance of six (6) inches or one (1) pipe diameter whichever is larger. Where the insulation is continuous through the hanger without interruption, an insulation protection system shall be used. Pipe hangers for hot water shall be adjustable clevis roller type with pipe covering protection saddle.

   Rigid pipe insulation thickness equal to adjoining insulation shall be installed in the space between the saddle and the pipe. The length of the tas saddle shall be a minimum of 12 inches and match the length of blocking used.

7. Pipe insulation shall be continuous through walls and floor openings, except where walls or floors are required to be fire-stopped, required to have a fire resisting rating or required to be gastight.

8. Insulation for Equipment

   All equipment listed below shall be insulated with 1-1/2” thick glass fiber board having a density of not less than 3.0 lbs./cubic foot and a thermal conductivity of not more than .23 btu/in/hr-sq. ft-°F at 75°F mean temperature. The insulation shall consist of an aluminum foil reinforced with fiberglass yarn and laminated to kraft. It shall be secured with copper—clad wire reinforced with fiberglass or pins and clips on 12” centers. All voids shall be filled with insulating cement; all joints and brakes in the vapor facing shall be adhered with vapor barrier
adhesive. The facing shall be finished with a 3-ply application of lagging adhesive, glass fabric reinforcing, and a final coat of lagging adhesive.

The following equipment shall be insulated:

Discharge and Blowoff Silencers.

B. Type A Insulation

1. Shall be installed on exposed interior and exterior blower discharge, process air, and mixing air pipes for the purpose of preventing injury to workers.

2. Shall be fiberglass preformed pipe insulation meeting or exceeding ASTM C547 class I requirements for pipes up to and including sixty (60) inches nominal pipe size. Thermal conductivity shall be 0.23 BTU-IN./HR. – sq. ft. - °F at 75°mean temperature.

3. Shall be two (2) inches thick around the pipe and fittings.

4. All flanges, valves, and in-line accessories shall be insulated.

C. Type B Insulation

1. Shall be installed on pipes carrying cold water for the purpose of eliminating sweating.

2. Shall be identical to Type A except that the thickness shall be one (1) inch around the pipe and fittings.

3. Flanges, valves and in line accessories shall not be insulated.

D. Insulation Jacketing.

All insulated piping shall be finished with strap-on jacketing with a clear acrylic factory applied coating. The jacket is to be manufactured from 0.16 inch thick for use indoors or 0.10-inch-thick stainless steel for use outdoors with an integrally bonded moisture barrier. It shall have a modified Pittsburg Z lock on the longitudinal seam. Jacketing to be secured with Fabstrap. All insulated fittings shall be furnished in the same manner, using 0.024” thick preformed fitting covers where available and fabricated covers made from the same material for specialties, valves flanges, trees, etc.

2.12 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves

1. Shall be the mechanical joint type of heavy cast iron construction.

2. The mechanical joints ends shall conform to AWWA C111 (ANSI A21.11).

3. Bolts and nuts shall be corrosion resistant, hexagonal and conform to ANSI B18.2.

4. Shall be designed for a minimum working pressure of 200 psi and shall be shop tested at 400 psi.
5. Shall have a flanged connection for the outlet to ANSI B16.1 class 125.

B. Tapping Valve
   1. Shall be supplied by the tapping sleeve manufacturer.
   2. Shall be non-rising stem gate valve cast iron bodied with bronze trim.
   3. Shall be rated for a working pressure of 200 psig.
   4. Shall be furnished as flanged by mechanical end connections.

C. Tapping Equipment
   1. Shall be supplied by the manufacturer of the sleeve.
   2. Shall be designed expressly for this work.
   3. Cutting tools shall be sharp to ensure a quick clean out.

D. Shall be as manufactured by AP Smith, Meuller or approved equal.

PART 3 – INSTALLATION

3.01 EXPOSED PIPING INSTALLATION

A. General

The contractor shall furnish all labor, tools, materials, and equipment necessary for installation and jointing of the pipe. All piping shall be installed in accordance with the Contract Drawings in a neat workmanlike manner and shall be set for accurate line and elevation. All piping shall be thoroughly cleaned before installation, and care shall be taken to keep the piping clean throughout the installation.
Before setting wall sleeves, pipes, castings and pipes to be cast in place, the Contractor shall check all contract drawings and figures which may have a direct bearing on the pipe locations. The contractor shall be responsible for the proper location of the pipes and appurtenances during the construction of a renovation of the tanks and structures.

Piping shall be connected to blowers, valves, equipment, etc., in accordance with the respective manufacturer’s recommendations.

For piping assembled with threaded, solvent, cemented, welded or soldered joints, liberal use of unions shall be made. Unions shall be provided close to main pieces of equipment and in branch lines to permit ready dismantling of piping without disturbing main pipelines or adjacent branch lines. A minimum of one union per straight run of pipe between fittings and/or valves with multiple lengths of pipe shall be used. Unions shall be placed downstream of the shut off or isolating valves.

All changes in directions or elevations shall be made with fittings except for flexible process tubing or as noted in the piping paragraphs.

Conflicts between piping systems and equipment or structures shall be presented to the engineer for determination of corrective measures before proceeding with the pipe installation.

B. Flanged Joints

1. Shall be made up with full face gaskets as specified in the piping paragraphs.

2. Shall have the flange faces bearing uniformly on the gaskets.

3. Shall have the flanges drawn together uniformly until the joint is tight.

4. No washers shall be permitted for the bolt and nut assemblies.

5. The length of the bolts shall be uniform and in accordance with the standards specified herein. The bolt’s maximum projection beyond the end of the nut shall be 0.25 inch. The bolt shall not fall short of the end of the nut.

C. Threaded Joints

1. All threads shall be clean, machine cut and all pipes shall be reamed before erection.

2. Tape and dies shall be cleaned, sharpened and in good condition.

3. All threaded joints shall be made tight with Teflon tape or with a good quality thread compound applied to the male threads only.

4. After having been set up, a joint shall not be backed off unless the joint is broken, the threads cleaned, and new tape is applied.
D. Welded Joints

1. Shall be shop fabricated in accordance with the standards and specifications contained herein.

2. Field welding shall be permitted only up the written permission of the engineer for carbon steel pipe and only when it can be demonstrated that the interior of the pipe can be satisfactorily lined and inspected. Welding in the field shall be performed only when requested on the shop drawings and approved by the Owner and Engineer in writing as specified herein.

All welding shall be performed in accordance with ANSI B31.1 and AWWA C206 except as modified or supplemented herein. All welders shall be AWS certified in accordance with AWWA C206, and ANSI B31 requirements.

Pipe and fittings with wall thicknesses of 3/16 inch and larger shall have ends beveled for welding. Bevels shall be 30 degrees with a maximum of 37-1/2 degrees. The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping. Welding shall be continuous around the joint and shall be completed without interruption. Welds shall be of the single vee butt type, of sound weld metal thoroughly fused into the ends of the pipe and into the bottom of the vee. Welds shall be free from cold spots, pinholes, oxide inclusions, burrs, snags, rough projections or other defects.

Filler metal for welding shall be of the same composition as the base metal. All welding of steel pipe flanges shall be in accordance with requirements of AWWA C207 and ANSI B31.1.

3. Shall be made up in accordance with standards and specifications listed herein.

   ANSI B31.1 Code for Pressure Piping
   American Welding Society (AWS) Standards
   AWWA C206
   API 1104 AWWA C207

4. Welding shall be performed by welders certified by the American Welding Society and shall qualify for AR-2 class welding as defined by ANSI B31.1. Welders shall have their current certificate available for the Engineer’s inspection.

5. Each welder shall be required to identify his weld with his specific code marking signifying his name and number assigned.

6. For piping systems with service temperatures in excess of 120° F, each welder shall be examined at the job site by the Contractor in the presence of the Engineer to determine the ability of the welder to meet the qualifications required. Welders shall be tested for all positions including welds with the axis horizontal (not rolled) and with the axis vertical. Each welder shall be allowed to weld only if the position in which he has qualified. It shall be the Contractor’s responsibility to assign only the site tested welders to this piping.
7. When a welder fails to meet the prescribed welding qualifications and/or fails an on-site examination, or is responsible for a defective weld, that welder shall be retested on the job site. If he fails a second on-site examination, he shall be disqualified for work on the project.

8. Welded joints for carbon steel piping with nominal pipe sizes 2-inches and larger shall be electric arc welded.

9. Welded joints for carbon steel piping with nominal pipe sizes up to 2 inches shall be gas welded.

10. For nominal pipe sizes up to and including 3 inches, joints for welded pipe and fittings shall be socket type. For nominal pipe sizes over 3 inches, joints shall be full penetration butt type.

11. For piping with all welded joints indicated, flanges shall be located at all valves and equipment and in piping runs so that individual sections of pipe may be readily removed if necessary. The placement of flanges in individual pipe runs transporting steam, digester gas and natural gas shall be in accordance with the contract drawings. Flanged joint locations shall be clearly indicated on the shop drawings.

12. Piping and fittings with wall thicknesses of 3/16-inch and larger shall have ends beveled for welding. Where beveling is done by flame cutting surfaces shall be thoroughly cleaned of scale and oxidation immediately prior to welding. All beveling shall conform to recognized standards except as supplemented or modified herein.

13. Split welding rings shall be used for field joints on pipes with nominal pipe sizes over three inches to assure proper alignment, complete weld penetration, and prevention of weld spatter reaching the interior of the pipe.

14. Preheating: When the temperature of the pipe walls falls below 33 degrees F, the pipe walls shall be heated to approximately 100 degrees F plus or minus 5 degrees for a distance of 12 inches on each side of the weld before welding. The weld shall be finished before the pipe cools to 32 degrees F.

15. The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping.

16. Welding shall be continuous around the joint and shall be completed without interruption.

17. Welds shall be free from cold spots, pinholes, oxide inclusions or other defects such as burrs, snags, or rough projections.

18. If permitted, filler metal for welding shall be of the same composition as the base metal.

19. Defective welds shall be replaced and reinspected. Repairing defective welds by adding weld material over the defect or by peening will not be permitted. Welder responsible for defective welds must be qualified.

20. All welds shall be hydrostatically tested.
3.02 PIPE SUPPORT SYSTEMS

A. General

All supports and parts required for the installation of the piping systems shall conform to the requirements of Chapter 1, Section 6 of the ANSI Code for Pressure Piping (B31.1) and MSS Standard Practice SP-58 except as modified and supplemented by the requirements set forth herein. All piping shall be supported in such a manner to fulfill the intent of this specification.

All piping shall be rigidly supported from the building structure by approved hangers, inserts, and supports. No piping shall be supported from other piping or from metal stairs, ladders, and walkways.

The Contractor shall install pipe supports in conformance with these specifications unless otherwise shown on the Contract Drawings. Where deviations and modifications are required, they shall be made only with the permission of the Engineer. A detailed layout of pipe supports shall be submitted for approval.

Supports shall not be ordered or fabricated prior to the engineer’s approval of the submittal material. Submittal of pipe supports shall be in accordance with this specification Division 1. Submittal shall contain an expansion/contraction design analysis, support analysis and design calculations prepared and certified by a professional engineer licensed in the State of New York to practice engineering and recognized as an expert in design of pipe support systems stating that the pipe support systems comply with the requirements of the specifications and are adequate for use.

Guided pipe supports and fixed (anchor) supports of type shown on the contract drawing shall be furnished and installed. Saddles, and pipe clamps are required to prevent point loading on the stainless-steel piping. Generally piping shall be supported from below or on trapeze hangers where applicable and as shown on the contract drawings.

The Contractor shall be responsible for the adequacy and support spacing of the pipe supports. Piping support systems including hangers shall be capable of supporting and bearing the pipe in all conditions of operation. The support systems shall allow for free expansion and contraction of the piping and connecting equipment and prevent excessive stresses from being introduced into the piping and connecting equipment. Pipe guides shall be furnished and installed to prevent axial misalignment.

The support systems shall be designed for a differential temperature of 180° F. The system shall incorporate the proper number of expansion joints to accommodate expansion and contraction based upon the selected and approved locations of fixed (anchor) supports. Anchors and structural attachments shall be designed in accordance with MSS SP58 and MSS SP59 to sustain the imposed thrusts due to internal pressure (15 psig) and forces due to expansion. The piping support systems including expansion joints shown on the Contract Drawings is a suggested system of locating fixed and sliding supports. The Contractor may modify the layout shown by support of the design analysis of the support system that is to be submitted for approval.
Each section of the pipeline shall be laid out and all connections made while the pipe is in temporary supports. After completion of connections the pipe may be clamped in position. When piping is correctly installed, a clamp or pipe connection may be loosed or removed without displacement of the pipeline.

Supporting appurtenances shall be arranged to prevent undue stress on equipment to which piping is connected. Supporting appurtenances shall provide the desired pitch as specified or required for proper drainage of the piping. The pipe suspension shall prevent excessive stress, excessive variation in supporting force, and possible resonance with imposed vibration while the system is in operation. All valves and valve operators shall be rigidly supported independently of the piping. Vertical runs of pipe shall be supported independently of the connected horizontal runs. All vertical pipes shall be supported at each floor or at intervals of no more than 10 feet by approved pipe collars, clamps, brackets or wall rests.

All piping shall be supported independently of the equipment to which it is connected. All inline devices shall be removable without the need for temporary supports for adjacent and connecting piping.

In general, the type of pipe supports to be used shall be as follows:

<table>
<thead>
<tr>
<th>Height of Centerline of Piping Above Floor</th>
<th>Type of Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 6 feet</td>
<td>Adjustable pipe saddle supports</td>
</tr>
<tr>
<td>Greater than 6 feet</td>
<td>Hangers or brackets</td>
</tr>
</tbody>
</table>

Wall bracket supports shall be used where pipe is installed adjacent to a structural column and can be supported form same. Where it is not feasible to install hanger supports, adjustable pipe saddle supports may be used with the permission of the engineer. Specifications for the bracket, saddle, and hanger supports are hereinafter given in the schedule of pipe supports.

For all couplings, supports shall tie placed on each side and as close to the coupling as possible. Supports shall be of the guide types which prevent axial movement resulting in pipe deflection or misalignment.

Structural steel members can be used to support pipe with the approval of the Engineer.

Where a specific pipe support is called for on the drawings, this support shall be used as and where indicated for the specific application. In general, spacing of supports shall be as specified herein unless specifically modified by the Engineer.

All support, saddles, bearing plates and hangers, shall support by direct contact the pipe a minimum of 120 degrees around, except as specified herein.

Pipe supports shall not be attached to equipment bases.
Where inserts or expansion anchors are being installed in concrete slabs, or floors, the insert or anchors shall be placed no closer than five (5) inches from the edge.

B. Support Spacing

The distance between supports shall not exceed that listed in the attached schedule. If the pipe to be supported is not listed in the schedule, the next smaller nominal pipe size spacing shall be used. In all cases, there shall be a minimum of one support per laying length of pipe on uninterrupted horizontal runs. This support shall be placed within one (1) foot of the joint. If the pipe manufacturer recommends a smaller spacing interval than specified herein, then the manufacturer’s spacing shall be used. The distance between supports shall not exceed that listed in the following schedule:

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inches)</th>
<th>Metallic Piping (feet)</th>
<th>PVC Piping (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½”</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>¾” up to 1 1/2”</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2” to 3”</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4”</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6” and larger</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

C. Place Hangers and Hanger Rods

Hangers shall be designed so that they cannot become disengaged by movements of the supported pipe. Lock nuts shall be used on all hangers. All piping systems shall be supported by means of hangers having an individual means of vertical adjustment for leveling of lines after piping is in place. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing. All expansion bolts shall be stainless steel and shall be capable of supporting the maximum working load of the road which is attached to it. When hanger rods are over eighteen (18) inches in length, lateral bracing to the structure shall be provided very fourth hanger.

D. Thrust Restraint

1. Pipe anchors shall be spaced to divide pipe into sections. Anchors shall be located at valves, changes in direction of piping, and major branch connections. Anchors shall be of a type recommended by the pipe manufactured and approved by the Engineer.

2. Harnessing Sleeve Type Coupling and Flanged Adapters
   On all piping where sleeve type couplings and flanged adapters are located near fittings or valves, tie rods shall span across the coupling as specified herein to restrain
movements of the pipe along its axial direction. Such restraints can be deleted if both ends of the pipe are anchored in a concrete structure with no fitting or valve occurring within the span length, in the suction piping to a pump where the coupling is between the pump and valve, at diffuser assembly connections, or when the water pressure measured at the crown of the pipe is less than five (5) feet.

All sleeve type couplings shall be harnessed except where noted. The harnessing shall be as shown on the drawings or as specified herein. Harnessing for steel pipe shall be in accordance with AWWA Manual M11 for the pipe size and pressure, working or test whichever is greater.

Where the distance between adjacent flanges is in excess of ten (10) feet or where a harness cannot be used, the pipe supports adjacent to the coupling shall restrain the piping preventing any linear or angular movement resulting in the pipe separating from the coupling or misalignment in the joint.

3. Where expansion joints are used, control units shall be used. All tie rods and control units shall be installed in accordance with the manufacturer’s recommended procedures. Nuts shall be backed off to allow for expansion and contraction.

4. In general, all valves and fittings shall be restrained in an approved manner such that the unbalanced force developed at them shall be supported independent of the piping system.

E. Piping Support System Materials

All stainless-steel pipe supports, hangers, etc. shall be prepared and shop painted in accordance with Sections 09800 and 09900.

Hanger rods, nuts, bolts, U-guides, anchor pipe clamps and 1/8-inch-thick continuous saddles shall be Type 315 stainless steel.

Interior faces of saddles shall be Teflon or graphite coated to allow the piping to expand freely.

Universal trapezes, angle or channel trapezes shall be stainless steel. Self-drilling flush seals or expansion shields shall be stainless steel. Pipe hanger flanges, washers and bevel washers shall be stainless steel.

3.04 FLUSHING AND TESTING

A. General

The contractor shall furnish all necessary labor and equipment required for the field tests specified below including, but not limited to, air compressor, gauges, conduit caps, temporary pipe and connections. The Contractor shall provide water for all flushing and testing, at his own expense, and may use only water from an approved source. The Contractor shall also furnish and install all means and apparatus necessary for getting the water into the pipeline.
and flushing and testing; including pumps, gauges, and meters, any necessary plugs and caps and any temporary blow off piping required to discharge water, etc., complete with any necessary reaction blocking to prevent pipe movement during the flushing and testing. All pipelines shall be flushed and tested in such lengths or sections as agreed upon among the County, Engineer, and Contractor. The Contractor shall give the County and Engineer reasonable notice of the time when he intends to test portions of the pipelines. The County reserves the right, within reason, to request flushing and testing of any section or portion of a pipeline.

B. Flushing

At the conclusion of the installation work, the Contractor shall thoroughly clean all new pipes by flushing with water or other means to remove all dirt, stones, pieces of wood, etc. which may have entered the pipe during the construction period. If after this cleaning any construction remains, they shall be corrected by the Contractor, at his own expense, to the satisfaction of the County. Pipelines shall be flushed at a rate of at least 2.5 feet per second for a duration suitable to the County.

C. Pressure Testing for Water and Process Piping

After flushing, all pipelines except air piping shall be hydrostatically tested in accordance with Suffolk County Sewer Agency Specifications for sewer construction.

The Contractor shall furnish, install complete with reaction blocking, the necessary plugs and caps required for this operation.

Any leaks or defective pipe disclosed by the hydrostatic test shall be corrected by the contractor, at his own expense, and the test repeated until all such piping shows tight.

D. Pressure and Leakage Test for Air Piping including Diffuser Assemblies

The Contractor shall prepare and submit an air piping testing plan and schedule for review and approval by the Engineer.

Air piping shall be tested with water at 25 psig before insulation in installed. Air piping shall be leak free for a successful test. Piping shall hold the test pressure for a period of at least three consecutive hours. The Contractor shall identify and isolate all equipment mounted in or on the piping which cannot handle the specified test pressure and isolate them during the test. The equipment and adjacent piping shall be tested at their design working pressure after the piping has passed the higher-pressure test.

3.05 DISINFECTION

Prior to placing the potable water systems in service, they shall be disinfected in accordance with AWWA Standard C651 and any additional requirements prescribed by the public health authorities having jurisdiction.

The form of chlorine for disinfection and the method of chlorine application shall be proposed by the contractor and approved by the county before the disinfection process is started.
The disinfection procedure shall be repeated until satisfactory bacteriological sampling has been achieved.

3.06 **REDUCING BRANCH CONNECTIONS**

All reducing branch connections shall be made up with tee fittings, saddles, branchlets, or special tapped tee fittings provided with a boss. No pipe wall shall be tapped unless the tap is made with a tapping saddle or sleeve.

3.07 **PAINTING AND IDENTIFICATION**

Piping and supports shall be field painted as specified in Sections 09900 and 09901. The piping contents shall be identified in accordance with the color code specified in Section 09900.

**PART 4 - PIPING SCHEDULES**

4.01 **ABBREVIATIONS AND LEGENDS**

A. Service

<table>
<thead>
<tr>
<th>BST-I</th>
<th>BST-E</th>
<th>PAA</th>
<th>PAB</th>
<th>DF</th>
<th>SD</th>
<th>SO</th>
<th>RS</th>
<th>WS</th>
<th>PI</th>
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<tbody>
<tr>
<td>STL</td>
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<td>PE</td>
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<td>P PR</td>
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</tr>
</tbody>
</table>

B. Material

| CU | PCCP | PVC | RCP | SS | SP | STL | DI | CL | PE |

<table>
<thead>
<tr>
<th>P</th>
<th>PR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BESST System Influent</td>
<td>BESST System Effluent</td>
</tr>
<tr>
<td>Process Air Above Tank Level</td>
<td>Process Air Below Tank Level</td>
</tr>
<tr>
<td>Drum Filter Piping</td>
<td>Sludge Decant</td>
</tr>
<tr>
<td>Sludge Draw Off Piping</td>
<td>Return Sludge</td>
</tr>
<tr>
<td>Waste Sludge Plant Influent</td>
<td></td>
</tr>
</tbody>
</table>

Copper

Prestressed Concrete Cylinder Type
Polyvinylchloride
Reinforced Concrete Pipe
Stainless Steel
Cast Iron Soil Pipe
Carbon Steel
Ductile Iron
Cement Lining
Polyethylene Lining
Painted

Primed
I Insulated  
MI Malleable Iron  
PA Petroleum Asphalzic Coating

C. Type of Joint

MJ Mechanical Joint  
MC Mechanical Coupling FLG Flanged  
Gr Grooved  
Sld Soldered  
Sol Solvent Welded  
PO Push on THD Threaded WLD Welded

D. Type of Fitting

SS Stainless Steel STL Carbon Steel MI Malleable Iron

4.02 SCHEDULE

The schedules are presented on the following pages.

SCHEDULE OF PROPERTIES

Note: All pipe hanger components shall be constructed of Stainless Steel 316.

<table>
<thead>
<tr>
<th>Diameter of Pipe</th>
<th>Hanger Type</th>
<th>Dia. Of Hanger Rod</th>
<th>Pipe Saddle Supports</th>
<th>Bracket Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>To 2½”</td>
<td>Fig. 65</td>
<td>3/8”</td>
<td>N/A</td>
<td>Fig. 194</td>
</tr>
<tr>
<td>2 ½” up to 4”</td>
<td>Fig. 260</td>
<td>½”</td>
<td>Fig. 264</td>
<td>Fig. 195</td>
</tr>
<tr>
<td>4”</td>
<td>Fig. 260</td>
<td>5/8”</td>
<td>Fig. 264</td>
<td>Fig. 199</td>
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<tr>
<td>6”</td>
<td>Fig. 260</td>
<td>¾”</td>
<td>Fig. 264</td>
<td>Fig. 199</td>
</tr>
<tr>
<td>8” to 10”</td>
<td>Fig. 260</td>
<td>7/8”</td>
<td>Fig. 264</td>
<td>Fig. 199</td>
</tr>
<tr>
<td>12”</td>
<td>Fig. 260</td>
<td>7/8”</td>
<td>Fig. 264</td>
<td>Fig. 199</td>
</tr>
<tr>
<td>14” &amp; Larger</td>
<td>(2)</td>
<td>(1)</td>
<td>(1) Fig. 264</td>
<td>Fig. 199 (3)</td>
</tr>
</tbody>
</table>

Note: Figure numbers shown in this schedule refer to Anvil/Grinnell Company, Inc. and are used to indicate type and size required. Equivalent models by FM Stainless Fasteners or approved equal shall be acceptable.
(1) Use multiple hanger rods.
(2) Trapeze with chair.
(3) To be used for 14” pipes only. Bracket supports not to be used for large pipes.

<table>
<thead>
<tr>
<th>SVCE</th>
<th>MT’L</th>
<th>TYPE OF JOINT</th>
<th>PROTECTION INTERIOR OR EXTERIOR</th>
<th>INSULATION REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>DI</td>
<td>FLG,GR</td>
<td>DI</td>
<td>CL</td>
</tr>
<tr>
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<td>PVC</td>
<td>FLG</td>
<td>PVC</td>
<td></td>
</tr>
<tr>
<td>BST—E</td>
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<td>FLG</td>
<td>DI</td>
<td>CL</td>
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<tr>
<td>SD</td>
<td>PVC</td>
<td>FLG</td>
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SECTION 09900

PAINTING AND COATING

PART 1

1.1 GENERAL INTENT

A. THE INTENT OF THIS SPECIFICATIONS IS TO PROVIDE THE MATERIAL AND WORKMANSHIP NECESSARY TO PRODUCE COMPLETE PROTECTION OF THE SURFACES TO BE COATED FOR SUWANNEE COUNTY. THIS INCLUDES ALL SURFACE PREPARATION, PRE-TREATMENT, COATING APPLICATION, TOUCH-UP OF FACTORY COATED SURFACES, PROTECTION OF SURFACES NOT TO BE COATED, CLEAN-UP, AND APPURTENANT WORK, ALL IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS. THROUGHOUT THIS SPECIFICATION “ENGINEER” REFERS TO NORTH FLORIDA PROFESSIONAL SERVICES OR CONTRACT MANAGER. AND “OWNER” REFERS TO SUWANNEE COUNTY.

1.2 PURPOSE

A. THE PURPOSE OF THIS SPECIFICATION IS TO GENERALLY OUTLINE THE WORK CONTEMPLATED FOR THE PAINTING AND PROTECTIVE COATING WORK PERFORMED FOR SUWANNEE COUNTY, INCLUDING CONTRACT OPERATIONS, CAPITAL IMPROVEMENT PROJECTS, AND DEVELOPER CONTRIBUTED ASSETS AS DEFINED UNDER SCOPE BELOW; TOGETHER WITH THE GENERAL CONDITIONS, SPECIAL PROVISIONS AND ALL OTHER TECHNICAL SPECIFICATIONS INCLUDED HEREWITH. ALL PAINTS AND MATERIALS USED ON INTERIOR TANK OR TREATMENT UNIT SURFACES SHALL CONFORM TO AWWA AND/OR FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP) REGULATIONS AS THEY MAY APPLY TO POTABLE WATER OR WASTEWATER SERVICE. THE MANUFACTURER FURNISHING THE COATING MATERIAL MAY BE REQUIRED TO FURNISH CERTIFICATION TO THE ENGINEER/OWNER THAT THE MATERIALS MEET THESE PROVISIONS.

1.3 DESCRIPTION

A. THE EXTENT OF PAINTING WORK IS SHOWN ON THE PROJECT DRAWINGS, CONTRACTS AND SCHEDULES, AND AS SPECIFIED HEREIN.

B. THE WORK INCLUDES PAINTING AND FINISHING OF INTERIOR AND EXTERIOR EXPOSED ITEMS AND SURFACES THROUGHOUT THE PROJECT, EXCEPT AS OTHERWISE SPECIFIED OR SHOWN ON THE DRAWINGS.

1. SURFACE PREPARATION, PRIMING AND COATS OF PAINT SPECIFIED ARE IN ADDITION TO SHOP-PRIMING AND SURFACE TREATMENT SPECIFIED UNDER OTHER SECTIONS OF THE WORK.

C. THE WORK INCLUDES FIELD PAINTING OF EXPOSED BARE AND COVERED PIPES AND DUCTS INCLUDING COLOR CODING, AND OF HANGERS, EXPOSED STEEL AND IRON WORK, TANKS, VESSELS, AND PRIMED METAL SURFACES OF EQUIPMENT INSTALLED UNDER THE MECHANICAL AND ELECTRICAL WORK, EXCEPT AS OTHERWISE INDICATED.
D. Paint all exposed surfaces normally painted in the execution of a building project whether or not colors are designated in “schedules”. Where items or surfaces are not specifically mentioned, or are not specifically excluded from the painting work, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Owner will select these from standard colors available for the materials systems specified.

1.4 Painting Not Included

A. The following categories of work are not included as part of the field-applied finish work, unless otherwise noted on the drawings or in the contract documents.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, metal fabrications, hollow metal work, and similar items. Also, for fabricated components such as shop-fabricated or factory-built mechanical and electrical equipment or accessories.

2. Pre-Finished Items: Unless otherwise shown or specified, do not include painting when factory-finishing or installer finishing is specified for such items as, but not limited to, finished electrical equipment including light fixtures, switchgear and distribution cabinets.

3. Concealed Surfaces: Unless otherwise shown or specified, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas. Painting of galvanized work that will be concealed in the completed work is not required. Do not paint structural steel to be encaised in concrete, nor structural steel specified not to be painted under Division S. Except for touch-up as specified in Part 3, painting of shop primed structural steel and ferrous metals that will be concealed in the completed work is not required.

4. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plating, copper, bronze and similar finished materials will not require finish painting, unless otherwise specified.

5. Operating and Machined Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, machined surfaces, grease fittings, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting unless otherwise specified.

a. Do not paint over any code-requiring labels, such as Underwriter’s Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
6. **OTHER SURFACES**: Do not apply to glass, manhole frames and covers, aluminum platform gratings, stair treads, door thresholds, concrete wearing surfaces, or other walking surfaces unless otherwise specified.

1.5 CODES, STANDARDS AND REGULATIONS

A. **THE WORK HEREIN SPECIFIED SHALL BE PERFORMED IN A LEGALLY ACCEPTABLE MANNER, AND IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN ANY AND ALL LICENSES, PERMITS, AND LEGAL APPROVALS REQUIRED TO PERFORM THE WORK SPECIFIED.**

B. **ALL MATERIAL AND WORK COVERED BY THIS SPECIFICATION SHALL COMPLY WITH ALL CURRENTLY APPROVED OR ACCEPTED PROVISIONS OF APPLICABLE CODES AND STANDARDS PUBLISHED BY THE FOLLOWING ORGANIZATIONS:**

- **ANSI** - AMERICAN NATIONAL STANDARDS INSTITUTE
  11 WEST 42ND
  NEW YORK, NY 10036
  212-642-4900

- **API** - AMERICAN PETROLEUM INSTITUTE
  1220 L STREET N.W.
  WASHINGTON, DC 20005
  202-682-8000

- **ASTM** - AMERICAN SOCIETY FOR TESTING AND MATERIALS
  100 BARR HARBOUR DR.
  WEST CONSHOHOCKEN, PA. 19428
  610-832-9500

- **AWS** - AMERICAN WELDING SOCIETY
  550 N.W. LEJEUNE RD.
  MIAMI, FL 33126
  305-443-9353

- **AWWA** - AMERICAN WATER WORKS ASSOCIATION
  6666 WEST QUINCY AVENUE
  DENVER, CO. 80235
  303-794-7711

- **FM** - FACTORY MUTUAL RESEARCH
  1151 BOSTON-PROVIDENCE TURNPIKE
  NORWOOD, MA 02062
  617-762-4300

- **NACE** - NATIONAL ASSOCIATION OF CORROSION ENGINEERS
  PO BOX 218340
  HOUSTON, TX 77218 1440
  SOUTH CREEK DR.
C. **THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND ORDINANCES.**
1.6 ACCEPTABLE COATING MANUFACTURERS

A. EXCEPT AS OTHERWISE INDICATED HEREIN, MATERIALS SPECIFIED ARE FROM THE CATALOG OF THE Kop-Coat, Inc. listed below. Materials by other manufacturers approved by the Engineer are acceptable provided that they are established to the satisfaction of the Engineer as being compatible with and of equal quality to the coatings of the company listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed material that the material meets the specified requirements and is equivalent or better than the listed materials in the following properties:

1. QUALITY
2. DURABILITY
3. RESISTANCE TO ABRASION AND PHYSICAL DAMAGE
4. LIFE EXPECTANCY
5. ABILITY TO RECOAT IN FUTURE
6. SOLIDS CONTENT BY VOLUME
7. DRY FILM THICKNESS PER COAT
8. COMPATIBILITY WITH OTHER COATINGS
9. SUITABILITY FOR THE INTENDED SERVICE
10. RESISTANCE TO CHEMICAL ATTACK
11. TEMPERATURE LIMITATIONS IN SERVICE AND DURING APPLICATION
12. TYPE AND QUALITY OF RECOMMENDED UNDERCOATS AND TOPCOATS
13. EASE OF APPLICATION
14. EASE OF REPAIRING DAMAGED AREAS
15. STABILITY OF COLORS

B. THE COST OF ALL TESTING AND ANALYZING OF THE PROPOSED SUBSTITUTE MATERIALS THAT MAY BE REQUIRED BY THE ENGINEER, SHALL BE PAID BY THE CONTRACTOR. IF THE PROPOSED SUBSTITUTION REQUIRES CHANGES IN THE CONTRACT WORK, THE CONTRACTOR SHALL BEAR ALL SUCH COSTS INVOLVED AND THE COSTS OF ALLIED TRDES AFFECTED BY THE SUBSTITUTION. THESE SUBSTITUTIONS FOR OTHER MANUFACTURERS MUST BE MADE AND APPROVED PRIOR TO THE BID DATE OPENING.

C. MATERIAL SOURCES: Kop-Coat Inc. is the standard of quality for the industrial coating materials specified in this Section. Where paint numbers are listed, it is to show the type and quality of coatings that are required. For convenience of reference, this specification includes product designations for coatings and coating colors as manufactured by the Kop-Coat Inc., St. Louis, MO. 800-547-2468. Other acceptable manufacturers are, Keefer and Long, Watertown, CT. 203-274-6701, and Tnemec Co., Kansas City, MO. 816-483-3400, and Porter International, Louisville, KY. 502-588-9769. Proposed substitute materials must be shown to satisfy the material descriptions and to equal or exceed the properties of the listed materials as required above in Paragraph 1-06 A.
1.7 SUBMITTALS

A. Coating Materials List: The CONTRACTOR shall provide six (6) copies of a coating materials list which indicates the manufacturer and the coating number, keyed to the coating schedule herein, for approval of the ENGINEER. The submittals shall be made sufficiently in advance of the coating operations to allow ample time for checking, correcting, resubmitting and rechecking.

B. Paint Manufacturer’s Information: For each paint system to be used, the CONTRACTOR shall submit the following listed data prior to beginning painting operations.

1. Paint manufacturer’s data sheet for each product used.
2. Paint manufacturer’s instructions and recommendations on surface preparation and application.
3. Colors available for each product (where applicable).
4. Compatibility of shop and field applied coatings (where applicable).
5. Material safety data sheet for each product used.

C. Samples and Manufacturer’s Certificate: Provide all submittals, including the following, as specified in Division 1.

1. Submit manufacturer’s standard color chart for color selection.
2. Submit specimens, approximately 8 by 10 inches in size, for custom mixed colors for approval, not including color coding colors.
3. Where equipment is customarily shipped with a standard finish, submit samples of the proposed color and finish for approval prior to shipping.
4. Furnish affidavits from the manufacturer certifying that materials furnished conform to the requirements specified and that paint products have been checked for compatibility.
5. Submit a supplementary schedule of paint products with mil thickness, and solids by volume, including all paint applied in the shop and in the field. Provide a schedule that is in accordance with the recommendations of the paint manufacturer.
6. Furnish affidavits from the manufacturer certifying that coatings in immersion service contain no water-soluble solvents or corrosion inhibitive (active) pigments with slight water solubility.

1.8 DELIVERY AND STORAGE

A. Deliver all coating materials to the job site in original, new and unbroken, sealed packages and containers bearing manufacturer’s name and label, and the following information, all of which shall be plainly legible at the time of use:

1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer’s stock number and date of manufacturer.
4. **Manufacturer’s Formula or Specification Number.**
5. **Manufacturer’s Batch Number.**
6. **Manufacturer’s Name.**
7. **Contents by Volume, for Major Pigment and Vehicle Constituents.**
8. **Thinning Instructions.**
9. **Application Instructions.**
10. **Color Name and Number.**
11. **Expiration Date.**

B. **Store Paint Materials and Painting Tools and Equipment**, including solvents and cleaning materials, in a well ventilated, dry area and away from high heat. Do not store in building or structure being painted, nor leave overnight therein. Follow manufacturer’s recommendations for the safe storage of paints and solvents. **Contractor** shall store materials in compliance with all local, state, and federal regulations.

### 1.9 Quality Assurance

A. **Inspection by the Engineer**, or the waiver of inspection of any particular portion of the work, shall not relieve the **Contractor** of his responsibility to perform the work in accordance with these specifications.

B. **Inspection Devices**: The **Contractor** shall furnish, until final acceptance of the work, inspection devices in good working condition for the detection of holidays, measurement of surface profile, and measurement of dry film thicknesses of the protective coatings. Surface preparation comparison visual standards, profile and dry film thickness devices shall be made available for the **Engineer’s** use at all times while coating is being done. The **Contractor** shall provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the **Engineer**.

C. **Surface Cleanliness**: Preparation of metallic surfaces shall be based upon comparison with SSPC-VIS 1 (ASTM D2200), and as described herein. The **Contractor** shall furnish the photographic standards. To facilitate inspection, the **Contractor** shall, on the first day of abrasive blasting operations, abrasive blast metal panels to the standards specified. Plates shall measure a minimum of 8.5 inches by 11 inches. Panels meeting the requirements of the Specifications shall be initiated by the **Contractor** and the **Owner’s** representative and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of abrasive blasting and shall be used as a comparison standard throughout the project. The **Contractor** shall provide SSPC-VIS 1 Surface Preparation Standards for use during the abrasive blasting operations.

D. **Surface Profile**: The blast abrasive shall be suitable to achieve the blast profile as required for the coating system used. The **Contractor** shall furnish for the **Engineer’s** use, a Keane-Tator Surface Comparator No. 372 or approved equal.
E. **Film Thickness Testing:** On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" (SSPC-PA2), using a magnetic-type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, Positector 2000 or approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least eight (8) hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

F. **Holiday Testing:** The CONTRACTOR shall holiday test all coated ferrous surfaces inside a steel reservoir, or other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer’s printed instructions and then retested.

1. **Coatings With Thickness Exceeding 20 Mils:** For surfaces having a total dry film coating thickness exceeding 20 mils: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or approved equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. **Coatings With Thickness of 20 Mils or Less:** For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M-1 non-destructive type holiday detector, K-D Bird Dog or approved equal shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal shall be added to the water prior to wetting the detector sponge.

1.10 **Manufacturer’s Representative**

A. The CONTRACTOR shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support and as may be necessary to resolve field problems attributable or associated with the manufacturer’s products furnished under this contract or the application thereof.

1.11 **Safety and Health Requirements**

A. **General:** The CONTRACTOR shall provide and require use of personal protective and safety equipment for persons working in or about the project site, in accordance with requirements of OSHA Safety and Health Standards for Construction (29CFR 1910, 1915, and 1926) its revisions, and all other applicable regulations. The CONTRACTOR shall also comply with the coating manufacturer’s printed instructions, appropriate technical bulletins, manuals, and material safety data sheets in the handling of potentially hazardous or harmful materials.
B. **HEAD AND FACE PROTECTION AND RESPIRATORY DEVICES:** The CONTRACTOR shall require all persons to wear protective helmets while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air purifying, half-mask or mouthpiece respirators with appropriate filters. Barrier creams shall be used on any exposed areas of skin.

C. **VENTILATION:** Where ventilation is used to control hazardous exposure, all equipment shall be explosion proof. Forced air ventilation shall be provided to reduce the concentration of air contaminants to the degree such that a hazard does not exist and to assist in the proper curing of coatings applied in a confined area. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

D. **SOUND LEVELS:** Whenever the occupational noise exposure exceeds maximum allowable sound levels permitted under OSHA regulations, the CONTRACTOR shall provide and require the use of approved hearing protection devices.

E. **ILLUMINATION:** Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the ENGINEER, the CONTRACTOR shall provide additional illumination to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the ENGINEER.

F. **TEMPORARY ACCESS:** All temporary ladders and scaffolding shall conform to applicable safety requirements. Scaffolding shall be erected where requested by the ENGINEER to facilitate inspection and shall be moved by the CONTRACTOR to locations as requested by the ENGINEER.

G. **CLOTHS AND COTTON WASTE THAT MIGHT CONSTITUTE A FIRE HAZARD SHALL BE PLACED IN FIRE RESISTANT CLOSED METAL CONTAINERS UNTIL REMOVED FROM THE PROJECT SITE OR DESTROYED AT THE END OF EACH WORKDAY.**

**1.12 WARRANTY**

A. **ALL WORK COVERED UNDER THE CONTRACT SHALL BE GUARANTEED AGAINST DEFECTIVE WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE (1) YEAR AFTER COMPLETION AND ACCEPTANCE OF THE WORK. A FIRST ANNIVERSARY INSPECTION WILL BE SCHEDULED BY THE CONTRACTOR DURING THE ELEVENTH (11TH) MONTH FOLLOWING ACCEPTANCE OF THE WORK. A REPORT SHALL BE FURNISHED TO THE OWNER DESCRIBING THE CONDITION OF THE PAINT SYSTEM AND OTHER WORK COVERED UNDER THE CONTRACT. TANK DRAINING SHALL BE COORDINATED WITH THE OWNER. ANY LATENT DEFECTS FOUND DURING THIS INSPECTION SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER. ANY LOCATION WHERE COATS OF PAINT HAVE PEELED OFF, BUBBLED OR CRACKED, AND ANY LOCATION WHERE RUSTING IS EVIDENT, SHALL BE CONSIDERED A FAILURE OF THE PAINT SYSTEM. THE CONTRACTOR SHALL MAKE REPAIRS AT ALL POINTS WHERE FAILURES ARE OBSERVED BY REMOVING THE DETERIORATED COATING, CLEANING THE SURFACES AND RECOATING WITH THE SAME PAINT SYSTEM. ANY SUCH REPAIR WORK SHALL BE COMPLETED BY THE CONTRACTOR WITHIN THIRTY (30) DAYS AFTER WRITTEN NOTICE OF SUCH DEFECTS UNLESS OTHERWISE NEGOTIATED.**
B. **Failure on the part of the Contractor to schedule this warranty inspection will not relieve him of warranty responsibility and any defects found by the Owner after the normal warranty period will be assumed to have occurred during the one (1) year while the warranty was in effect.**

### PART 2 PRODUCTS AND COATING SYSTEMS

#### 2.1 GENERAL

**A. Definitions:** The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pre-treatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

**B. Compatibility:** In any coating system, only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the Engineer, a barrier coat shall be applied between all existing prime coats and subsequent field coats to insure compatibility.

#### 2.2 COLORS AND FINISHES

**A. **All colors and shades of colors for all coats of paint shall be as selected or specified. Paint colors, surface treatment, gloss, and finishes, are indicated or specified in the "schedules" of the contract documents. Color and gloss not indicated or specified will be selected by the Owner.

**B. **Each coat shall be of a slightly different shade, as directed by the Engineer, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer’s standard color samples or shall be customer mixed to match color samples furnished by the Engineer. Final acceptance of colors will be from samples applied on the job.

**C. **Color pigments: pure, non-fading, applicable types to suit the substrates and service indicated.

**D. **Paint coordination: review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Furnish information to manufacturers, fabricators, suppliers and others where necessary on the characteristics of the finish materials to be used, to ensure compatible prime coats of use. Provide barrier coats over incompatible primers or remove and re-prime as required.

**E. **Color coding: all exposed piping in structures, aboveground or in pipe trenches, shall be color code painted in strict accordance with the color code chart presented in
Paragraph 3-15 of this section. All colors shall be as specified or as selected by the owner.

2.3 Undercoats and Thinners

A. Undercoats: Provide undercoat paint produced by the same manufacturer as the finish coats.

B. Thinners: Use only thinners approved by the paint manufacturer and use only within recommended limits.

2.4 Industrial Coating Systems

A. The contractor shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

B. Protective Coating Materials: Products shall be standard coatings produced by recognized manufacturers regularly engaged in production of such materials for application on essentially identical facilities to those proposed in this project. Where requested, the contractor shall provide the engineer with the names of not less than ten (10) successful applications of the proposed manufacturer’s products, which have been proven over a three (3) year period of time, demonstrating compliance with this specification requirement.

C. System 1 - Alkyd Enamel: High quality gloss or semi-gloss, long oil alkyd finish with a minimum solids content of 57% by volume. Primer as recommended by manufacturer.

1. Painting New Construction

   a. Prime coat except wood surfaces (DFT = 3.0 mils) Kop-Coat 622-LCF Primer.
   
   b. Prime coat for wood surfaces (DFT = 1.5 mils) Kop-Coat Rustarmor 500 Enamel thinned 15% with Kop-Coat 4000 Thinner.
   
   c. Finish coats, two (Total DFT = 3.0 mils) Kop-Coat Rustarmor 500 Enamel.
   
   d. Total system DFT except wood surfaces = 6.0 mils
   Total system DFT for wood surfaces = 4.5 mils

2. Repainting Existing Surfaces

   a. The cleaned steel is to be hand brushed twice with (DFT = 4.0 mils) Kop-Coat 622-LCF Primer. Completely work the primer into all the irregular surface faces of the steel.
   
   b. Finish coats, two (Total DFT = 3.0 mils) Kop-Coat Rustarmor 500 Enamel.
D. **SYSTEM 2 - SILICONE ALKYD ENAMEL**: HIGH QUALITY GLOSS ALKYD, MEDIUM LONG OIL ALKYD FINISH. MINIMUM SOLIDS CONTENT OF 48% BY VOLUME. PRIME COAT TO BE AS RECOMMENDED BY MANUFACTURER.

1. **PAINTING NEW CONSTRUCTION**
   a. PRIME COAT (DFT = 3.0 MILS) KOP-COAT 622-LCF PRIMER.
   b. FINISH COATS, TWO (TOTAL DFT = 3.0 MILS) KOP-COAT SUB-SII B
   c. **TOTAL MILLAGE SHALL BE AT LEAST 7.0 MILS.**

2. **REPAINTING EXISTING SURFACES**
   a. **THE CLEANED STEEL IS TO BE HAND BRUSHED TWICE WITH** (DFT = 4.0 MILS) KOP-COAT 622-LCF PRIMER.
   b. **FINISH COATS, TWO** (TOTAL DFT = 3.0 MILS) KOP-COAT 1515 SILICONE ALKYD.
   c. **TOTAL MILLAGE SHALL BE AT LEAST 7.0 MILS.**

E. **SYSTEM 3 - HIGH BUILD EPOXY**: HIGH BUILD POLYAMIDE EPOXY COATING, RESISTANT TO SPLASH, SPILLAGE AND FUMES OF DILUTE ACIDS, BASES AND SALTS, AND WITH HIGH RESISTANCE TO WEATHERING. COATING MATERIAL SHALL HAVE A MINIMUM SOLIDS CONTENT OF 56% BY VOLUME. PRIME COAT TO BE A RUST INHIBITIVE EPOXY PRIMER AS RECOMMENDED BY MANUFACTURER.

1. PRIME COAT (DFT = 1.5 MILS) KOP-COAT 294 EPOXY PRIMER.
2. **FINISH COATS, TWO** (TOTAL DFT = 10.0 MILS) KOP-COAT HI-GARD EPOXY COATING.
3. **TOTAL SYSTEM DFT = 11.5 MILS.**

F. **SYSTEM 4 ACRYLIC LATEX (HIGH SHEEN)**: SINGLE COMPONENT, WATER BASED ACRYLIC LATEX WITH A FUNGICIDE ADDITIVE AND MINIMUM SOLIDS CONTENT OF 35% BY VOLUME. PRIME COAT TO BE AS RECOMMENDED BY MANUFACTURER.

1. PRIME COAT (DFT = 2.0 MILS) AS RECOMMENDED BY MANUFACTURER, IF NEEDED.
2. **FINISH COATS, TWO** (TOTAL DFT = 3.0 MILS) KOP-COAT 620 ACRYLIC EMULSION.
3. **TOTAL SYSTEM DFT = 5.0 MILS (WITH PRIME COAT). 3.0 MILS (WITHOUT PRIME COAT).**

G. **SYSTEM 5 - ACRYLIC, CONCRETE AND MASONRY (FLAT)**: HIGH MOLECULAR WEIGHT ACRYLIC COATING MATERIAL WITH A MINIMUM SOLIDS CONTENT OF 41% BY VOLUME. PRIME COAT SHALL BE AN ACRYLIC FILLER AND SEALER FOR CONCRETE SURFACES.
1. **Painting New Construction**
   a. **Prime coat (filler/sealer)** Kop-Coat Concrete and Masonry Filler.
   b. **Finish coats, two (Total DFT = 3.0 mils)** Kop-Coat 600 Interior-Exterior Acrylic Emulsion.
   c. **Total system DFT = 3.0 mils.**

2. **Repainting Existing Surfaces**
   a. **Spot prime if needed with Kop-Coat Concrete and Masonry Filler to insure a consistent total finish appearance.**
   b. **Finish coats, two (Total DFT 3.0 mils) Kop-Coat 600 Interior-Exterior Acrylic Emulsion.**
   c. **Total millage shall be at least 3.0 mils.**

H. **System 6 - Coal Tar Epoxy, Steel: High build, 2-component amine or polyamide cured coal tar epoxy, solids content of at least 74% by volume, suitable for long term immersion in wastewater and for coating of buried surfaces, and conforming to or exceeding Corps of Engineers Specification C-200, or SSPC Paint 16. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field.**

   1. **Prime coat (DFT = 1.5 mils) Kop-Coat 654 Epoxy Primer.**
   2. **Finish coats, two (Total DFT = 20.0 mils) Kop-Coat Bitumastic No.300-M.**

**Note:** **Time between coats is critical and maximum times as stated by the manufacturer must not be exceeded.**

3. **Total system DFT = 21.5 mils (with prime coat). 20.0 mils (without prime coat).**

**Notes:**
   A. **Spot sandblast to SSPC-SP10 all areas damaged during erection, or areas not precoated before application of coating.**
   B. **All edges, nuts, bolts, lap joints, weld seams and the roof rim angle shall receive one brush-applied coat prior to the application of the complete spray coat.**

I. **System 7 - Coal Tar Epoxy, Concrete: High build, 2-component amine or polyamide cured coal tar epoxy, solids content of at least 74% by volume, suitable for long term immersion in wastewater and for coating of buried surfaces and conforming to or exceeding Corps. of Engineers Specification C-200, or SSPC Paint 16. Filler**
Compound shall be a 2-component epoxy material used to fill voids and provide a suitable surface for the application of the coal tar epoxy. Filler is worked into the concrete surface with a wide blade putty knife or a squeegee.

1. **First coat** - Kop-Coat Bitumastic No. 300-M, thinned 33 percent with Thinner 2000 and apply at the rate of 200-300 sq. ft. per gallon. Allow not more than 24 hours before applying additional coats at the normal, unthinned rate.

2. Finish coats, two (Total DFT = 20.0 mils) Kop-Coat Bitumastic No. 300-M.

**Note:** Time between coats is critical and maximum times as stated by the manufacturer must not be exceeded.

3. **Total system DFT = 20.0 mils.**

**J. System 8-Polyamide Cured Epoxy for Steel or Concrete Potable Water Storage Tanks or Treatment Units:** High build polyamide cured epoxy coating with solids contents of at least 56% by volume and a finish coat color of white. The material shall be capable of achieving at least 5 mils dry film thickness per coat. The epoxy coating material shall be suitable for long-term immersion service in potable water. The materials used shall appear on the latest published list of approved coatings for use in potable water issued by the Florida Department of Environmental Protection. Submit a written certification that the proposed materials meet the above regulatory agency standards and policies. Apply the material with a primer if recommended by the coating manufacturer. Thinners and additives shall also be in compliance with this paragraph.

1. **Steel Tanks or Treatment Units**
   a. **First coat** (DFT=5.0 mils) Kop-Coat Hi-Gard Epoxy. See notes (1), (2) and (3).
   b. **Finish coat** (DFT = 5.0 mils) Kop-Coat Hi-Gard Epoxy
   c. **Total system DFT = 10.0 mils**

**Notes:**

1. All sharp edges, weld burrs, weld spatter and surface irregularities shall be ground smooth before applying coating.

2. Touch-up coating to be done for areas damaged during erection, or areas not pre-coated. Spot sandblast to SSPC-SP10 before application of coating.

3. All edges, nuts, bolts, lap joints, weld seams and the roof rim angle shall receive one brush-applied coat prior to the application of the complete spray coat.
2. **Concrete Tanks or Treatment Units**
   
   a. **First coat (DFT = 4.0 mils)** Kop-Coat Hi-Gard Epoxy thinned 20% with Kop-Coat 2,000 Thinner.
   
   b. **Finish coat (DFT = 6.0 mils)** Kop-Coat Hi-Gard Epoxy.
   
   c. **Total system DFT = 10.0 mils.**

3. **Curing Period:** Prior to immersion, subject the completed system to at least 7 days of curing time with the substrate temperature at a minimum of 70 degrees F, or 10 days at a minimum of 60 degrees F. More curing time or a higher temperature shall be provided if recommended by the manufacturer. If the environmental conditions do not provide the necessary minimum temperature, use heated air to provide the necessary heat for curing. Other combinations of curing time and temperature may be used if the coating manufacturer presents satisfactory documentation and test results to substantiate that the degree of curing is equal or greater than curing for 7 days at 70 degrees F.

K. **System 9 - Polyurethane: High Gloss, 2-component Aliphatic Polyurethane** for use on steel, fiberglass and PVC. Coating material shall have a minimum solids content of 56% by volume. Prep surface as recommended by manufacture. Product is not recommended for interior building surfaces or continuous immersion.

1. **Prime coat (DFT = 3.0 mils)** Hi-Gard Epoxy

2. **Finish coats, two (total DFT=3.0 mils)** Kop-Coat 1122 BRS Linear Polyurethane

3. **Total system = 6.0 mils minimum**

**Execution**

**Part 3 Storage, Mixing and Thinning of Materials**

Manufacturer’s Recommendations: Unless otherwise specified herein, the coating manufacturer’s printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed. No substitutes or other deviations will be permitted without written permission of the Engineer. The Contractor shall supply the Engineer with copies of each manufacturer’s instructions in accordance with the requirements of Paragraph 1-07, “Submittals”.

A. **All protective coating materials shall be used within the manufacturer’s recommended shelf life.**
3.2 PREPARATION FOR COATING

A. GENERAL: All surfaces to receive protective coatings shall be cleaned as specified herein prior to application of said coatings. The CONTRACTOR shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Do not paint over dirt, rust, scale, oil, grease, moisture, scuffed surfaces or other foreign material or in conditions otherwise detrimental to the formation of a durable paint bond and film.

B. PROTECTION OF SURFACES NOT TO BE COATED: Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations. All hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.

C. PROTECTION OF ADJACENT WORK AND AREAS: Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair to the satisfaction of the OWNER any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

D. PROTECTION OF PAINTED SURFACES: Cleaning and coating shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

3.3 SURFACE PREPARATION STANDARDS

A. THE FOLLOWING REFERENCED SURFACE PREPARATION SPECIFICATIONS OF THE STEEL STRUCTURES PAINTING COUNCIL SHALL FORM A PART OF THIS SPECIFICATION:

1. SOLVENT CLEANING (SSPC-SP1): The method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces through the use of solvent, vapor, emulsion, alkaline, and/or steam.
2. **Hand Tool Cleaning (SSPC-SP2):** The method for removing all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter through the use of non-power hand tools.

3. **Power Tool Cleaning (SSPC-SP3):** The method for removing all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter through the use of power assisted hand tools.

4. **White Metal Blast Cleaning (SSPC-SP5):** The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint.

5. **Commercial Blast Cleaning (SSPC-SP6):** The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint. Evenly dispersed very light shadows, streaks, and discolorations caused by stains of rust, mill scale, and previously applied paint may remain on no more than 33% of the surface.

6. **Brush-off Blast Cleaning (SSPC-SP7):** The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface.

7. **Near-White Blast Cleaning (SSPC-SP10):** The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint. Evenly dispersed very light shadows, streaks, and discolorations caused by stains of rust, mill scale, and previously applied paint may remain on no more than 5% of the surface.

### 3.4 Surface Preparation

A. **General:** Perform preparation and cleaning procedures in strict accordance with the paint manufacturer’s instructions and as herein specified, for each particular substrate condition.

1. **Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.**

2. **Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces. Remove mildew in accordance with the paint manufacturer’s recommendations.**
3.5 NEW FERROUS METAL SURFACE PREPARATION (UNGALVANIZED)


B. WORKMANSHIP FOR METAL SURFACE PREPARATION SHALL BE IN CONFORMANCE WITH THE CURRENT SSPC STANDARDS AND THIS SECTION. BLAST CLEANED SURFACES SHALL MATCH THE STANDARD SAMPLES AVAILABLE FROM THE NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE) STANDARD TM-01-70.

C. ALL OIL, GREASE, WELDING FLUXES AND OTHER SURFACE CONTAMINANTS SHALL BE REMOVED BY ALKALINE CLEANING PER SSPC-SP1 PRIOR TO BLAST CLEANING.

D. ALL SHARP EDGES SHALL BE ROUNDED OR CHAMFERED AND ALL BURRS, SURFACE DEFECTS AND WELD SPLATTER SHALL BE GROUND SMOOTH PRIOR TO BLAST CLEANING.

E. THE TYPE AND SIZE OF ABRASIVE SHALL BE SELECTED TO PRODUCE A SURFACE PROFILE THAT MEETS THE COATING MANUFACTURER’S RECOMMENDATION FOR THE PARTICULAR COATING AND SERVICE CONDITIONS. CONTRACTOR SHALL SUBMIT DATA AND SAMPLES FOR APPROVAL ON ABRASIVES TO BE USED ON THE PROJECT. ABRASIVES THAT ARE USED SHALL BE DESIGNED FOR THE SPECIFIC PURPOSE OF BLAST CLEANING. ABRASIVES SHALL BE FREE OF CONTAMINANTS AND CHLORIDES. ORDINARY BUILDER’S SAND SHALL NOT BE CONSIDERED TO BE APPROVED ABRASIVE MATERIAL. ENGINEER WILL PERIODICALLY SAMPLE ABRASIVES USED AT THE JOB SITE FOR COMPARISON WITH APPROVED SUBMITTED MATERIALS.

F. THE ABRASIVE SHALL NOT BE REUSED UNLESS OTHERWISE APPROVED BY THE ENGINEER. FOR AUTOMATED SHOP BLASTING SYSTEMS, CLEAN OIL AND MOISTURE-FREE ABRASIVES SHALL BE MAINTAINED.

G. THE CONTRACTOR SHALL COMPLY WITH THE APPLICABLE FEDERAL, STATE, AND LOCAL AIR POLLUTION CONTROL REGULATIONS FOR BLAST CLEANING.

H. COMPRESSED AIR FOR AIR BLAST CLEANING SHALL BE SUPPLIED AT ADEQUATE PRESSURE FROM WELL-MAINTAINED COMPRESSORS EQUIPPED WITH OIL/MOISTURE SEPARATORS WHICH REMOVE ALL CONTAMINANTS.

I. SURFACES SHALL BE CLEANED OF ALL DUST AND RESIDUAL PARTICLES OF THE CLEANING OPERATION BY DRY AIR BLAST CLEANING, VACUUMING OR OTHER APPROVED METHOD PRIOR TO PAINTING.

J. ENCLOSED AREAS AND OTHER AREAS WHERE DUST SETTLING IS A PROBLEM SHALL BE VACUUM CLEANED AND WIPED WITH A TACK CLOTH.

K. DAMAGED OR DEFECTIVE COATING SHALL BE REMOVED BY THE SPECIFIED BLAST CLEANING TO MEET THE CLEAN SURFACE REQUIREMENTS BEFORE RECOATING.
L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, the SSPC-SP2, Hand Tool Cleaning, or SSPC-SP3, Power Tool Cleaning, will be permitted.

M. Shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied. Valves, castings, ductile iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.

N. Shop primed equipment shall be alkaline cleaned in the field before finish coats are applied.

3.6 Ferrous Metal Surface Preparation (Galvanized)

A. All installation and erection caused blemishes to galvanized surfaces shall be touched up in accordance with ASTM A780 prior to coating.

B. Galvanized ferrous metal shall be alkaline cleaned per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used.

C. Surfaces shall be pretreated with Kop-Coat 40 Passivator, one coat 0.4 mil DFT, prior to finish coating, in accordance with the printed recommendations of the coating manufacturer.

3.7 Surface Preparation of Ferrous Surfaces with Existing Coatings, excluding Steel Tank or Treatment Unit Interiors (in addition to requirements in paragraphs 3-05 and 3-06).

A. General: All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The CONTRACTOR shall determine the generic type of the existing coatings by laboratory testing, at no additional cost to the OWNER.

B. Abrasive Blast Cleaning: The CONTRACTOR shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-Off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

C. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings, the CONTRACTOR shall apply intermediate coatings per the paint
MANUFACTURER’S RECOMMENDATION FOR THE SPECIFIED ABRASIVE BLAST CLEANING. A SMALL TRIAL APPLICATION SHALL BE CONDUCTED FOR COMPATIBILITY PRIOR TO PAINTING LARGE AREAS.

D. UNKNOWN COATINGS: COATINGS OF UNKNOWN COMPOSITION SHALL BE COMPLETELY REMOVED PRIOR TO APPLICATION OF NEW COATINGS.

3.8 SURFACE PREPARATION FOR REPAINTING EXISTING STEEL

A. THE ENTIRE STRUCTURE IS TO BE COMPLETELY PRESSURE WASHED AT 3,000 TO 5,000 PSI WITH POTABLE WATER.

B. ALL AREAS SHALL BE CLEANED/SANDBLASTED TO THE SURFACE PREPARATION STANDARDS AS SPECIFIED HEREIN, OR SUPERCEDED BY THE BID FORM.

C. ALL CLEANED AREAS ARE TO BE PRIMED THE SAME WORKDAY THAT THEY ARE CLEANED AND BLASTED.

3.9 PRESSURE WASH CLEANING FOR REPAINTING EXISTING CONCRETE

A. THE ENTIRE STRUCTURE IS TO BE PRESSURE WASHED AT 3,000 TO 5,000 PSI WITH A SOLUTION OF 50% WATER AND BLEACH TO YIELD A MIXTURE WITH A MINIMUM CONCENTRATION OF 2-1/2% SODIUM HYPOCHLORITE.

B. THE ENTIRE STRUCTURE IS TO BE COMPLETELY RINSED BY PRESSURE WASHING AT 3,000 TO 5,000 PSI WITH POTABLE WATER.

3.10 CONCRETE AND CONCRETE BLOCK MASONRY SURFACE PREPARATION

A. SURFACE PREPARATION SHALL NOT BEGIN UNTIL AT LEAST 30 DAYS AFTER THE CONCRETE HAS BEEN PLACED.

B. ALL EFFLORESCENCE, CHALK, DUST, DIRT, OIL AND GREASE SHALL BE REMOVED BY DETERGENT CLEANING PER SSPC-SP1 BEFORE ABRASIVE BLAST CLEANING.

C. CONCRETE, CONCRETE BLOCK MASONRY SURFACES, PREVIOUSLY PAINTED CONCRETE AND MASONRY AND DETERIORATED CONCRETE AND MASONRY SURFACES TO BE COATED SHALL BE ABRASIVE BLAST CLEANED TO REMOVE LAITANCE, PAINT, DETERIORATED CONCRETE, AND ROUGHEN THE ENTIRE SURFACE EQUIVALENT TO THE SURFACE OF THE No. 80 GRIT FLINT SANDPAPER. CONCRETE SHALL HAVE A CONSISTENT, EVEN TEXTURE (VOID FREE) AND SHALL BE PATCHED WHERE NEEDED.

D. DETERMINE THE ALKALINITY AND MOISTURE CONTENT OF THE SURFACES TO BE PAINTED BY PERFORMING APPROPRIATE TESTS. IF THE SURFACES ARE FOUND TO BE SUFFICIENTLY ALKALINE TO CAUSE BLISTERING AND BURNING OF THE FINISH PAINT, CORRECT THIS CONDITION BEFORE APPLICATION OF PAINT. DO NOT PAINT OVER SURFACES WHERE THE MOISTURE CONTENT EXCEEDS THAT PERMITTED IN THE MANUFACTURER’S PRINTED DIRECTIONS.
E. If acid etching is required by the coating application instructions, the treatment shall be made after sandblasting. After acid etching, rinse surfaces with clean water to neutralize the acid and test the pH. The pH shall be between 7.0 and 8.0.

F. Surfaces shall be clean and dry and as recommended by the coating manufacturer before coating is started.

G. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or approved equal.

3.11 Plastic, Fiberglass and Nonferrous Metals Surface Preparation

A. Plastic and fiberglass surfaces shall be sanded or brush off blast cleaned, SSPC-SP7, prior to solvent cleaning with a chemical compatible with the coating system primer. If blast cleaned, use 60-80 mesh abrasive.

B. Non-ferrous metal surfaces shall be solvent cleaned, SSPC-SP1, followed by sanding or brush off blast cleaning, SSPC-SP7.

C. All surfaces shall be clean and dry prior to coating application.

3.12 Wood Surface Preparation

A. Clean wood surfaces to be painted of all dust, dirt, grease, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, with either manual or mechanical means, as applicable, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic woodfiller. Sandpaper smooth when dried and dust off.

B. Prime or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood.

3.13 Workmanship

A. Skilled craftsmen and experienced supervision shall be used on all work.

B. Clean drop cloths shall be used. All damage to surfaces resulting from the work hereunder shall be leaned, repaired, and refinshed to the complete satisfaction of the Engineer, at no cost to the owner.

C. All coatings shall be applied under dry and dust-free conditions. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure that they have been thoroughly cleaned and that they receive an adequate thickness of coating.
MATERIAL. THE FINISHED SURFACES SHALL BE FREE FROM RUNS, DROPS, RIDGES, WAVES, LAPS, ALLIGATORING, BRUSH MARKS, AND VARIATIONS IN COLOR, TEXTURE, AND FINISH. THE HIDING SHALL BE SO COMPLETE THAT THE ADDITION OF ANOTHER COAT WOULD NOT INCREASE THE HIDING. SPECIAL ATTENTION SHALL BE GIVEN TO INSURE THAT EDGES, CORNERS, CREVICES, WELDS, AND SIMILAR AREAS RECEIVE A FILM THICKNESS EQUIVALENT TO ADJACENT AREAS, AND INSTALLATIONS SHALL BE PROTECTED BY THE USE OF DROP CLOTHS OR OTHER APPROVED PRECAUTIONARY MEASURES.

3.14 SHOP COATING REQUIREMENTS

A. ALL ITEMS OF EQUIPMENT, OR PARTS OF EQUIPMENT WHICH ARE NOT SUBMERGED IN SERVICE, SHALL BE SHOP PRIMED AND THEN FINISH COATED IN THE FIELD AFTER INSTALLATION WITH THE SPECIFIED OR APPROVED COLOR. THE METHODS, MATERIALS, APPLICATION, EQUIPMENT AND ALL OTHER DETAILS OF SHOP PAINTING SHALL COMPLY WITH THESE SPECIFICATIONS. IF THE SHOP PRIMER REQUIRES TOP-COATING WITHIN A SPECIFIED PERIOD OF TIME, THE EQUIPMENT SHALL BE FINISH COATED IN THE SHOP AND THEN TOUCH-UP PAINTED AFTER INSTALLATION.

B. ALL ITEMS OF EQUIPMENT, OR PARTS AND SURFACES OF EQUIPMENT WHICH ARE SUBMERGED WHEN IN SERVICE, WITH THE EXCEPTION OF PUMPS AND VALVES SHALL HAVE ALL SURFACE PREPARATION AND COATING WORK PERFORMED IN THE FIELD.

C. THE INTERIOR SURFACES OF STEEL WATER RESERVOIRS SHALL HAVE ALL SURFACE PREPARATION AND COATING WORK PERFORMED IN THE FIELD.

D. FOR CERTAIN PIECES OF EQUIPMENT IT MAY BE UNDESIRABLE OR IMPRACTICAL TO APPLY FINISH COATINGS IN THE FIELD. SUCH EQUIPMENT MAY INCLUDE ENGINE GENERATOR SETS, EQUIPMENT SUCH AS ELECTRICAL CONTROL PANELS, SWITCH-GEAR OR MAIN CONTROL BOARDS, SUBMERGED PARTS OF THE PUMPS, FERROUS METAL PASSAGES IN VALVES, OR OTHER ITEMS WHERE IT IS NOT POSSIBLE TO OBTAIN THE SPECIFIED QUALITY IN THE FIELD. SUCH EQUIPMENT SHALL BE SHOP PRIMED AND FINISH COATED IN THE FIELD WITH THE IDENTICAL MATERIAL AFTER INSTALLATION. THE CONTRACTOR SHALL REQUIRE THE MANUFACTURER OF EACH SUCH PIECE OF EQUIPMENT TO CERTIFY AS PART OF ITS SHOP DRAWINGS THAT THE SURFACE PREPARATION IS IN ACCORDANCE WITH THESE SPECIFICATIONS. THE COATING MATERIAL DATA SHEET SHALL BE SUBMITTED WITH THE SHOP DRAWINGS FOR THE EQUIPMENT.

E. FOR CERTAIN SMALL PIECES OF EQUIPMENT THE MANUFACTURER MAY HAVE A STANDARD COATING SYSTEM WHICH IS SUITABLE FOR THE INTENDED SERVICE CONDITIONS. IN SUCH CASES, THE FINAL DETERMINATION OF SUITABILITY WILL BE MADE DURING REVIEW OF THE SHOP DRAWING SUBMITTALS. EQUIPMENT OF THIS TYPE GENERALLY INCLUDES ONLY INDOOR EQUIPMENT SUCH AS INSTRUMENTS, SMALL COMPRESSORS, AND CHEMICAL METERING PUMPS.

F. SHOP PAINTED SURFACES SHALL BE PROTECTED DURING SHIPMENT AND HANDLING BY SUITABLE PROVISIONS INCLUDING PADDING, BLOCKING, AND THE USE OF CANVAS OR NYLON SLINGS. PRIMED SURFACES SHALL NOT BE EXPOSED TO THE WEATHER FOR MORE THAN 6 MONTHS BEFORE FINISH COATING, OR LESS TIME IF RECOMMENDED BY THE COATING MANUFACTURER.
G. Damage to shop-applied coatings shall be repaired in accordance with this section and the coating manufacturer’s printed instructions prior to finish painting.

H. The contractor shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this section. Copies of applicable coating manufacturer’s data sheets shall be submitted with equipment shop drawings.

3.15 Application of Coatings

A. The application of protective coatings to steel substrates shall be in accordance with "Paint Application Specification No. 1", (SSPC-A-1), Steel Structures Painting Council.

B. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The contractor shall schedule such inspection with the engineer in advance.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be painted in the same working day.

D. Coatings shall be prepared, mixed and applied in accordance with the manufacturer’s instructions and recommendations, and these specifications. If directions differ, the most stringent requirements shall be followed.

E. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

F. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the coating materials. Remove the film, and if necessary, strain the material before using.

G. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe (brushed or gloved) painting for these areas.

H. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

1. Job Conditions: The following job conditions will be strictly enforced during the application of coatings for the project.

   1. Apply water-base coatings only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F and 90 degrees F unless otherwise permitted by the paint manufacturer’s printed instructions.
2. **Apply solvent-thinned coatings only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F and 95 degrees F unless otherwise permitted by the paint manufacturer’s printed instructions.**

3. **Do not apply paint in dust or smoke laden atmosphere, high winds, rain, fog or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer’s printed instructions.**

4. **Do not apply coatings when the temperature is less than 5 degrees F above the dewpoint. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Weather Bureau psychrometric tables.**

5. **Do not apply coatings when the outside air temperature is expected to drop below 45 degrees F or less than 5 degrees F above the dewpoint, within 8 hours after application of the coating.**

6. **Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.**

J. **The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust-free.**

K. **General Considerations:**

1. **Apply paint as specified and in accordance with the manufacturer’s directions. Use brushes for applying first coat on wood and on metals other than steel and sheet metal and items fabricated from steel and sheet metal. For other coats on wood, metal and other substrates, use applicators and techniques best suited for the type of material being applied.**

2. **Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.**

3. **Paint surfaces behind movable equipment the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment with prime coat only before final installation of equipment.**

4. **Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.**

5. **Paint the back sides of removable or hinged covers to match the exposed surfaces.**
6. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated or specified.

7. Sand lightly between each succeeding enamel coat.

8. Omit the field prime coat on shop-primed surfaces and touch up painted metal surfaces which are not to be finished painted and which will not be exposed to view in the completed work. Do not omit primer on metal surfaces specified to be finish coated or on metal surfaces that will be exposed to view in the completed work.

L. Scheduled Painting:

1. Apply the first coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

M. Minimum Coating Thickness: Apply each material at not less than the manufacturer’s recommended spreading rate, to establish a total dry film thickness as specified or, if not specified, as recommended by coating manufacturer.

N. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces, and on the outside or exterior of buildings or structures:

1. Mechanical items to be painted include, but are not limited to, the following:
   a. Piping, valves, pipe hangers, and supports.
   b. Pumps
   c. Tanks
   d. Duct work, insulation
   e. Motors, mechanical equipment, and supports
   f. Accessory items

2. Electrical items to be painted include, but are not limited to, the following:
   
   A. Conduit and fittings
   b. Switchgear

O. Prime Coats: Apply a prime coat to material, equipment and surfaces which are required to be painted or finished, and which have not been prime coated by others.
CLEAN AND PRIME UNPRIMED FERROUS METALS AS SOON AS POSSIBLE AFTER DELIVERY OF THE METALS TO THE JOB SITE. RECOAT PRIMED AND SEALED SURFACES WHERE THERE IS EVIDENCE OF SUCTION SPOTS OR /UNSEALED AREAS IN FIRST COAT, TO ASSURE A FINISH COAT WITH NO BURN-THROUGH OR OTHER DEFECTS DUE TO INSUFFICIENT SEALING.

P. **STIPPLE ENAMEL FINISH:** ROLL AND REDISTRIBUTE PAINT TO AN EVEN AND FINE TEXTURE. LEAVE NO EVIDENCE OF ROLLING SUCH AS LAPS, IRREGULARITY IN TEXTURE, SKID MARKS, OR OTHER SURFACES IMPERFECTIONS.

Q. **PIGMENTED, OPAQUE FINISHES:** COMPLETELY COVER TO PROVIDE AN OPAQUE, SMOOTH SURFACE OF UNIFORM FINISH, COLOR, APPEARANCE AND COVERAGE. CLOUDINESS, SPOTTING, HOLIDAYS, LAPS, BRUSH MARKS, RUNS, SAGS, ROPINESS OR OTHER SURFACE IMPERFECTIONS WILL NOT BE ACCEPTABLE.

R. **COMPLETED WORK:** MATCH APPROVED SAMPLES FOR COLOR, TEXTURE AND COVERAGE. REMOVE, REFINISH OR REPAINT WORK NOT IN COMPLIANCE WITH SPECIFIED REQUIREMENTS.

### 3.16 CURING OF COATINGS

A. **THE CONTRACTOR SHALL PROVIDE CURING CONDITIONS IN ACCORDANCE WITH THE CONDITIONS RECOMMENDED BY THE COATING MATERIAL MANUFACTURER OR BY THESE SPECIFICATIONS, WHICHEREVER IS THE MORE STRINGENT REQUIREMENT, PRIOR TO PLACING THE COMPLETED COATING SYSTEM INTO SERVICE.**

B. **FORCED AIR VENTILATION OF STEEL RESERVOIRS AND ENCLOSED HYDRAULIC STRUCTURES:** FORCED AIR VENTILATION IS REQUIRED FOR THE APPLICATION AND CURING OF COATINGS ON THE INTERIOR SURFACES OF STEEL RESERVOIRS AND ENCLOSED HYDRAULIC STRUCTURES. DURING CURING PERIODS, CONTINUOUSLY EXHAUST AIR FROM A MANHOLE IN THE LOWEST SHELL RING OR IN THE CASE OF AN ENCLOSED HYDRAULIC STRUCTURE, FROM THE LOWEST LEVEL OF THE STRUCTURE USING PORTABLE DUCTING. AFTER ALL INTERIOR COATING OPERATIONS HAVE BEEN COMPLETED, PROVIDE A FINAL CURING PERIOD FOR A MINIMUM OF 10 DAYS, DURING WHICH TIME THE FORCED AIR VENTILATION SYSTEM SHALL OPERATE CONTINUOUSLY. FOR ADDITIONAL REQUIREMENTS, REFER TO THE SPECIFIC WRITTEN INSTRUCTIONS OF THE MANUFACTURER FOR THE COATING SYSTEM BEING APPLIED.

### 3.17 COLOR CODING

A. **ALL EXPOSED PIPING SHALL BE COLOR CODED. AFTER THE FINISH COAT HAS BEEN APPLIED, LABEL EACH LINE WITH STENCILED LEGENDS IDENTIFYING THE NATURE OF THE PIPE CONTENTS AND THE DIRECTION OF FLOW. THIS STENCILED IDENTIFICATION SHALL APPEAR IN ONE OR MORE PLACES IN THE LINE AS DEEMED NECESSARY BY THE ENGINEER. STENCIL LEGENDS SHALL BE WHITE FOR ALL PIPE EXCEPT WHITE COLOR-CODED PIPE, WHICH SHALL HAVE BLACK LEGENDS. LABELS SHALL OCCUR A MINIMUM OF EVERY 15 FEET OF STRAIGHT PIPING AND AT ALL BENDS. MINIMUM STENCIL SIZE SHALL BE TWO-INCH LETTERS FOR 4-INCH AND LARGER DIAMETER PIPING AND ONE-INCH LETTERS FOR 2-INCH TO 3-1/2-INCH DIAMETER PIPING. PIPING 1-1/2-INCH DIAMETER AND SMALLER SHALL BE IDENTIFIED USING PLASTIC WRAP-AROUND PIPE MARKERS.**
B. ITEMS TO BE CODED BUT NOT SPECIFICALLY MENTIONED SHALL BE COATED IN A COLOR SELECTED BY THE ENGINEER OR OWNER.

C. ALL PAINTS/COATINGS USED IN POTABLE WATER CONTACT AREAS MUST HAVE AWWA AND EPA CLASSIFICATION AND APPROVALS.

D. ALL REQUIREMENTS OF THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) CONCERNING COLOR CODING AND SAFETY MARKINGS SHALL BE CONSIDERED PART OF THESE SPECIFICATIONS UNLESS SPECIFICALLY EXCLUDED.

E. ANY PAINT/COATING REQUIREMENTS/SPECIFICATIONS NOT SPECIFICALLY ADDRESSED IN THE FOREGOING SHALL BE DECIDED UPON AS REQUIRED BY THE ENGINEER.

F. EVERY VALVE OR CONNECTION, WHERE IT MAY BE POSSIBLE FOR A WORKER TO BE EXPOSED TO A HAZARDOUS SUBSTANCE, SHALL BE LABELED PER GENERAL INDUSTRY SAFETY ORDERS, ARTICLE 112, OSHA OCCUPATIONAL SAFETY AND HEALTH STANDARDS 29CFR1910.

G. COLOR CODE CHART

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<td></td>
</tr>
<tr>
<td>Reuse Water</td>
<td></td>
</tr>
<tr>
<td>Olive Green - Kop-Coat OSHA</td>
<td></td>
</tr>
<tr>
<td>Safety Green #2383</td>
<td></td>
</tr>
<tr>
<td>Aqua - Kop-Coat Marine Green</td>
<td></td>
</tr>
<tr>
<td>#7333</td>
<td></td>
</tr>
<tr>
<td>Dark Blue - Kop-Coat OSHA</td>
<td></td>
</tr>
<tr>
<td>Safety Blue A#183</td>
<td></td>
</tr>
<tr>
<td>Pantone Purple 522C - Kop-Coat OSHA Safety</td>
<td></td>
</tr>
</tbody>
</table>

| **CHEMICAL LINES/PIPING**    |                                            |
| Alum or Sodium Aluminate    | Orange - Kop-Coat OSHA Safety Orange #J498|
| Ammonia                     |                                            |
| Carbon Slurry               | White - Kop-Coat #0800                    |
| Chlorine (Gas/Solution)     | Black - Kop-Coat #C900                    |
| Fluoride                    | Yellow - Kop-Coat OSHA Safety Yellow #625 |
| Methanol                    | Light Blue w/Red Band - Kop-Coat Dawn     |
|                            | Blue #8155 with 6 bands of Kop-Coat OSHA  |
|                            | Safety Red #0508                          |
|                            | Red w/Yellow Band - Kop-Coat OSHA Safety  |
|                            | Red #0508 with 6" bands of Kop-Coat OSHA  |
|                            | Safety Yellow #S625                       |
| Lime Slurry                 | Light Green — Kop-Coat Eye-Rest Green      |
| Odophos                     | #2369 Violet — Kop-coat OSHA Safety Purple|
| Sulfuric Acid or            | #S585                                      |
| Sulfur Dioxide              | Light Green w/Yellow Band, Kop-Coat Eye-Rest Green #2369 with 6" bands of Kop-Coat OSHA Safety Yellow #S625 |
3.18 COATING SYSTEM SCHEDULES

A. COATING SYSTEM SCHEDULE, FERROUS METAL - NOT GALVANIZED (FM):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM-1</td>
<td>All exposed surfaces outdoors, exposed to normal industrial exposure</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>Urethane #9</td>
</tr>
<tr>
<td>FM-2</td>
<td>All exposed surfaces indoors and outdoors, exposed to moderate and severe industrial exposure</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(2b) Urethane #9</td>
</tr>
<tr>
<td>FM-3</td>
<td>Surfaces in Chlorination room, chlorine gas exposure</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(3) High Build Epoxy</td>
</tr>
<tr>
<td>SCHEDULE NO.</td>
<td>ITEM</td>
<td>SURFACE PREP.</td>
<td>SYSTEM NO.</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
<td>---------------</td>
<td>------------</td>
</tr>
<tr>
<td>FM-4</td>
<td>Surfaces submerged or intermittently submerged in potable water, including all surfaces lower than 2' above high water level and all surfaces inside enclosed hydraulic structures, tanks and treatment units, and all surfaces of valves, couplings and pumps</td>
<td>Near White Metal Blast Cleaning, SSPC-SP10</td>
<td>(3) or (8) High Build Epoxy</td>
</tr>
<tr>
<td>FM-5</td>
<td>Surfaces submerged or intermittently submerged in wastewater, including all surfaces lower than 2' above high water level and all surfaces inside enclosed hydraulic structures, tanks and treatment units and all surfaces of valves, couplings and pumps</td>
<td>Near White Metal Blast Cleaning, SSPC-SP10</td>
<td>(6) Coal Tar Epoxy or (3) High Build Epoxy (if color desired)</td>
</tr>
<tr>
<td>FM-6</td>
<td>Buried surfaces that are not specified to be coated elsewhere</td>
<td>Near White Metal Blast Cleaning, SSPC-SP10</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>FM-7</td>
<td>Indoor architectural sheet metal, flashings, door frames, and exposed ducts</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(1) Alkyd Enamel</td>
</tr>
</tbody>
</table>

FM-8 SURFACES OF INDOOR EQUIPMENT COMMERCIAL BLAST CLEANING, SSPC-SP6 ALKYD ENAMEL
B. COATING SYSTEM SCHEDULE, FERROUS METAL - GALVANIZED (FMG):

ALL GALVANIZED SURFACES EXCEPT FOR THE FOLLOWING ITEMS SHALL BE COATED UNLESS REQUIRED BY OTHER SECTIONS: (1) FLOOR GRATTINGS AND FRAMES, (2) HANDRAILS, (3) STAIR TREADS, (4) CHAIN LINK FENCING AND APPURTEANCES.

<table>
<thead>
<tr>
<th>SCHEDULE NO.</th>
<th>ITEM</th>
<th>SURFACE PREP.</th>
<th>SYSTEM NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMG-1</td>
<td>All exposed surfaces indoors and outdoors, except those included below</td>
<td>Solvent Cleaning per Paragraph 3-06</td>
<td>(1) Alkyd Enamel</td>
</tr>
<tr>
<td>FMG-2</td>
<td>All exposed surfaces indoors and outdoors, including surfaces in chlorinater room and chlorine storage room, except those included below</td>
<td>Solvent Cleaning per Paragraph 3-06</td>
<td>(3) or (8) High Build Epoxy</td>
</tr>
<tr>
<td>FMG-3</td>
<td>Surfaces buried or submerged in wastewater</td>
<td>Solvent Cleaning per Paragraph 3-06 or Brush Off Grade Blast Cleaning SSPC-SP7</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>FMG-4</td>
<td>Indoor architectural sheet metal, flashings, doors, frames, and exposed ducts</td>
<td>Solvent Cleaning per Paragraph 3-06</td>
<td>(1) Alkyd Enamel</td>
</tr>
</tbody>
</table>
C. COATING SYSTEM SCHEDULE, STEEL DIGESTER FLOATING COVERS AND DIGESTER GASHOLDERS (SD):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD-1</td>
<td>All ferrous surfaces submerged in water or sludge, including rim plate</td>
<td>White Metal Blast Cleaning, SSPC-SPS</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>SD-2</td>
<td>All ferrous surfaces exposed to digester gas</td>
<td>White Metal Blast Cleaning, SSPC-SPS</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>SD-3</td>
<td>All interior ferrous surfaces of gasholder shell, including top angle</td>
<td>White Metal Blast Cleaning, SSPC-SPS</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>SD-4</td>
<td>Exposed, outdoors</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(2) Silicone Alkyd Enamel or Urethane</td>
</tr>
</tbody>
</table>

D. COATING SYSTEM SCHEDULE, NON-FERROUS METAL, PLASTIC, FIBERGLASS (NFM):

WHERE ISOLATED NON-FERROUS PARTS ARE ASSOCIATED WITH EQUIPMENT OR PIPING, THE CONTRACTOR SHALL USE THE COATING SYSTEM FOR THE ADJACENT CONNECTED SURFACES. DO NOT COAT HANDRAILS, GRATINGS, FRAMES OR HATCHES. ONLY PRIMERS RECOMMENDED BY THE COATING MANUFACTURER SHALL BE USED.

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFM-1</td>
<td>All exposed surfaces indoors and outdoors, except those included below</td>
<td>Solvent Cleaning per Paragraph 3-09</td>
<td>(1) Alkyd Enamel</td>
</tr>
<tr>
<td>NFM-2</td>
<td>Chlorination room and chlorine storage room</td>
<td>Solvent Cleaning per Paragraph 3-09</td>
<td>(3) or (8) High Build Epoxy</td>
</tr>
<tr>
<td>NFM-3</td>
<td>Polyvinyl chloride plastic piping, and fiberglass surfaces, indoor and outdoors, or in structures not submerged</td>
<td>Solvent Cleaning per Paragraph 3-09</td>
<td>(4) Acrylic Latex</td>
</tr>
</tbody>
</table>
E. COATING SYSTEM SCHEDULE - CONCRETE AND CONCRETE BLOCK MASONRY (C):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1</td>
<td>Exposed, indoors and outdoors, as indicated on the plans</td>
<td>Per Paragraph 3-09</td>
<td>(5b) Acrylic-Concrete Repainting</td>
</tr>
<tr>
<td>C-2</td>
<td>Submerged in wastewater as indicated on the plans</td>
<td>Per Paragraph 3-10</td>
<td>(7) Coal Tar Epoxy-Concrete</td>
</tr>
<tr>
<td>C-3</td>
<td>Interior surfaces of sewer manholes, including sidewalls, bottom, and metal appurtenances, for manholes and L/S’s indicated on the plans</td>
<td>Per Paragraph 3-10</td>
<td>See Specification 09950</td>
</tr>
</tbody>
</table>

F. COATING SYSTEM SCHEDULE - WOOD (W):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-1</td>
<td>EXPOSED INDOORS AND OUTDOORS AS INDICATED ON THE PLANS</td>
<td>PER PARAGRAPH 2-12</td>
<td>(1) ALKYD ENAMEL</td>
</tr>
<tr>
<td>W-2</td>
<td>EXPOSED INDOORS AND OUTDOORS AS ACRYLIC INDICATED ON THE PLANS</td>
<td>PER PARAGRAPH 3-12</td>
<td>(4) LATEX</td>
</tr>
</tbody>
</table>

3.19 CLEAN-UP AND PROTECTION

A. CLEAN UP: DURING THE PROGRESS OF THE WORK, REMOVE FROM THE SITE ALL DISCARDED PAINT MATERIALS, RUBBISH, CANS AND RAGS AT THE END OF EACH WORKDAY. UPON COMPLETION OF PAINTING WORK, CLEAN WINDOW GLASS AND OTHER PAINT-SPATTERED SURFACES LOCATED ON SITE AND OFF SITE. REMOVE SPATTERED PAINT BY PROPER METHODS OF WASHING AND SCRAPING, USING CARE NOT TO SCRATCH OR OTHERWISE DAMAGE FINISHED SURFACES.

B. PROTECTION: PROTECT WORK OF OTHER TRADES LOCATED ON SITE AND OFF SITE, WHETHER TO BE PAINTED OR NOT, AGAINST DAMAGE BY PAINTING AND FINISHING WORK. CORRECT ANY DAMAGE BY CLEANING, REPAIRING OR REPLACING, AND REPAINTING.

1. PROVIDE "WET PAINT" SIGNS, AS REQUIRED, TO PROTECT NEWLY PAINTED FINISHES. REMOVE TEMPORARY PROTECTIVE WRAPPINGS PROVIDED BY OTHERS FOR PROTECTION OF THEIR WORK AFTER COMPLETION OF PAINTING OPERATIONS.
2. **AT THE COMPLETION OF WORK OF OTHER TRADES, TOUCH UP AND RESTORE ALL DAMAGED OR DEFACED PAINTED-surfaces.**

3.20 **APPEARANCE AND INSPECTION**

A. **ALL PAINTING SHALL BE ACCOMPLISHED IN A WORKMANLIKE MANNER AND SHALL BE FREE OF UNSIGHTLY SAGS, RUNS, BUBBLES, DRIPS, WAVES, LAPS, ALLIGATORING, UNNECESSARY BRUSH MARKS AND OVERSPRAY OR OTHER PHYSICAL DEFECTS AND SHALL BE UNIFORM IN COLOR.**

B. **THE CONTRACTOR SHALL PROVIDE ALL RIGGING, SCAFFOLDING AND OTHER EQUIPMENT NECESSARY FOR A SATISFACTORY INSPECTION OF A COMPLETE PAINT SYSTEM AND ACCEPTANCE BY THE ENGINEER/OWNER.**

C. **INSPECTION SHALL BE CONDUCTED BY AN INSPECTOR SELECTED BY THE ENGINEER/OWNER IN THE PRESENCE OF THE OWNER’S REPRESENTATIVE AND THE CONTRACTOR OR HIS REPRESENTATIVE. PROVISIONS FOR CALIBRATED AND FUNCTIONAL TEST EQUIPMENT IS THE RESPONSIBILITY OF THE CONTRACTOR.**
D. The paint film shall be free of pinholes and holidays as determined by the use of an approved holiday detector as defined in Paragraph 1-09 of this Section.

E. The paint film shall be randomly checked for dry film thickness as stipulated in the "Coating System" sections of these specifications. Thicknesses shall be checked with a properly calibrated and approved magnetic gauge as defined in Paragraph 1-09 of this Section.

3.21 REPAIR OF DEFECTS IN PAINT

A. Any defects discovered during inspection, such as low film millage, holidays or pinholes, shall be repaired with the same materials as used for the original finish coat(s). Excessive low millage could require extra full coat(s) of paint.

B. A final inspection will be conducted by the ENGINEER/OWNER or his representative after any necessary repairs and prior to final acceptance of the job.

3.22 DISINFECTION OF POTABLE WATER STORAGE TANKS

A. Description: This paragraph specifies disinfection procedures for potable water storage tanks.

B. Quality Assurance: The following documents are a part of this section as specified and modified. In case of conflict between the requirements of this paragraph and those of the listed documents, the requirements of this paragraph shall prevail.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWWA D105,</td>
<td>DISINFECTION OF WATER STORAGE FACILITIES</td>
</tr>
<tr>
<td>LATEST</td>
<td></td>
</tr>
<tr>
<td>REVISION</td>
<td></td>
</tr>
</tbody>
</table>

C. Information to be Provided: Affidavit of Compliance as described in AWWA D105.

D. After the tank has been painted and the interior surfaces have thoroughly dried, the CONTRACTOR shall remove all visible dirt and contaminating materials. The interior of the tank shall be disinfected in accordance with Chlorination Method 2 of AWWA D105. The CONTRACTOR shall furnish all of the chlorine required.

E. The CONTRACTOR shall be responsible for obtaining proper disinfection as determined by bacteriological testing. Samples for bacterial analyses will be taken and analyzed by the OWNER. Two consecutive samples are required to pass the bacteriological tests for the tank to comply with these disinfection requirements.

F. Water for filling the tank after the initial disinfection will be provided by the OWNER. If bacteriological testing shows the presence of coliform bacteria, the tank shall be
REDISINFECTED. THE CONTRACTOR SHALL PAY THE OWNER FOR WATER REQUIRED TO FILL THE TANK AFTER THE FIRST FILLING AT CURRENTLY APPROVED GENERAL SERVICE WATER RATES FOR THE OWNER.

END OF SECTION