

services in connection with this Contract. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically-treated type are used, at least one toilet will be furnished for every 10 employees. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

1.06 BARRIERS

- A. Barriers shall be provided as required to provide for use of site by Owner and other contractors and to protect existing facilities and adjacent properties from damage from construction operations.

1.07 ACCESS ROADS

- A. The Contractor shall establish and maintain temporary access roads to various parts of the site as required to complete the project.

1.08 CLEANING DURING CONSTRUCTION

- A. The Contractor shall control accumulation of waste material and rubbish, periodically disposing of it in an appropriate manner.
- B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.09 OWNER/ENGINEER'S FIELD OFFICE

- A. The Contractor shall provide a typical Engineer's field office trailer for the duration of the project. The field office trailer shall be a minimum 12 ft by 40 ft with a separate Engineer's office, potable water, restroom facilities, and meeting area.

1.10 CONTRACTOR'S FIELD OFFICE

- A. Not required.

1.11 PARKING

- A. Contractor shall provide and maintain suitable parking areas for the use of all construction workers and other performing work or furnishing services in connection with the project, as required to avoid any need for parking personnel vehicles where they may interfere with public traffic, OWNER'S operations, or construction activities.

1.12 REMOVAL

- A. Remove temporary facilities, materials, and equipment used for construction prior to Final Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities and return area to same or better condition than originally provided.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Comply with requirement stated in Conditions of the Contract and in specifications for administrative procedures in closing out the Work.

1.02 SUBSTANTIAL COMPLETION

- A. When Contractor considers the Work as substantially complete, he shall submit to the Engineer:
 - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of completion.
- C. Should the Engineer determine that the Work is not substantially complete:
 - 1. The Engineer will promptly notify the Contractor in writing, giving the reasons therefore.
 - 2. Contractor shall remedy the deficiencies in the Work and send a second written notice of substantial completion to the Engineer.
 - 3. The Engineer will reinspect the Work.
- D. When the Engineer finds that the Work is substantially complete, he will:
 - 1. Prepare and deliver to Owner a tentative Certificate of Substantial Completion, with a tentative list of items to be completed or corrected before final payment.
 - 2. After consideration of any objections made by the Owner as provided in Conditions of the Contract, and when the Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

- A. When Contractor considers the Work is complete, he shall submit written certification that:
 - 1. Contract Documents have been reviewed.
 - 2. Work has been inspected for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents.
 - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 - 5. Work is completed and ready for final inspection.
- B. The Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should the Engineer consider that the Work is incomplete or defective:
 - 1. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
 - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Engineer that the Work is complete.
 - 3. The Engineer will reinspect the Work.

1.04 REINSPECTION FEES

- A. Should the Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
 - 1. Owner will compensate the Engineer for such additional services.
 - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- A. Project Record Documents: To requirements of Section 01720.

- B. Warranties and Bonds: To requirements of Section 01740.
- C. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.
- D. Certificate of Insurance for Products and Completed Operations.
- E. Authorization of release of final payment from surety.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to the Engineer.
- B. Statement shall reflect all adjustments to the Contract Sum:
 - 1. The original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous change orders or written amendment.
 - b. Allowances
 - c. Unit prices
 - d. Deductions for uncorrected work
 - e. Penalties and bonuses
 - f. Deductions for liquidated damages
 - g. Deductions for reinspection payments
 - h. Other adjustments
 - 3. Total Contract Sum, as adjusted.
 - 4. Previous payments.
 - 5. Sum remaining due.
- C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Maintain at the site for the Owner one (1) record copy of:

1. Drawings
2. Specifications
3. Addenda
4. Change Orders and other modifications of the contract
5. Engineer's Field Orders or written instructions
6. Approved Shop Drawings, Working Drawings and Samples
7. Field Test records
8. Construction photographs
9. Current As-Built Drawings

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents
2. Provide locked cabinet or secure storage space for storage of samples

B. File documents and samples in accordance with CSI format with section numbers as provided herein.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

- D. Make documents and samples available at all times for inspection by the Owner.
- E. As a prerequisite for monthly progress payments, the Contractor is to exhibit the currently updated "Record Documents" for review by the Engineer and Owner.

1.03 MARKING DEVICES

- A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

1.04 RECORDING

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information concurrently with construction progress.
 - 1. Do not conceal any work until required information is recorded.
- C. Drawings: Legibly mark to record actual construction:
 - 1. Depths of various elements of foundation in relation to finish first floor datum
 - 2. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc.
 - 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - 4. Field changes of dimension and detail
 - 5. Changes made by Field Order or by Change Order
 - 6. Details not on original contract drawings
 - 7. Equipment and piping relocations
 - 8. Major architectural and structural changes including relocation of doors, windows, etc.
 - 9. Architectural schedule changes according to Contractor's records and shop drawings.

D. Specifications and Addenda: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number of Supplier of each product and item of equipment actually installed.
2. Changes made by Field Order or by Change Order.

E. Shop Drawings (after final review and approval): Provide five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

1.05 SUBMITTAL

A. At Contract closeout, deliver Record Documents to the Construction Manager for the Owner.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date
2. Project title and number
3. Contractor's name and address
4. Title and number of each Record Document
5. Signature of Contractor or his authorized representative

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Compile specified warranties and bonds, as in Article 15 of the General conditions and as specified in these Specifications
2. Co-execute submittals when so specified
3. Review submittals to verify compliance with Contract Documents
4. Submit to the Engineer for review and transmittal to Owner

1.02 SUBMITTAL REQUIREMENTS

- A. Assembly warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: Two each
- C. Table of Contents: Neatly type, in orderly sequence. Provide complete information for each item.
 1. Product of work item
 2. Firm, with name of principal, address and telephone number
 3. Scope
 4. Date of beginning of warranty, bond or service and maintenance contract
 5. Duration of warranty, bond or service maintenance contract
 6. Provide information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect the validity or warranty or bond.

7. Contractor, name of responsible principal, address and telephone number

1.03 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 1. Size 8-1/2 inches x 11 inches, punch sheets for standard three-post binder
 - a. Fold larger sheets to fit into binders.
 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
 - a. Title of Project.
 - b. Name of Contractor.
- C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of two inches.

1.04 WARRANTY SUBMITTALS REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the Contractor's for one (1) year, unless otherwise specified, commencing at the time of final acceptance by the Owner.
- B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Divisions 1 through 16 and which has at least a 1 hp motor or which lists for more than \$1,000. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not considered to be "major" in the Contractor's one-year warranty period even though certificates of warranty may not be required.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at the date of substantial completion, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two-year warranty from the manufacturer shall not relieve the Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.
- D. The Owner shall incur no labor or equipment cost during the guarantee period.

- E. Guarantee shall cover all necessary labor, equipment and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by the manufacturer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01850

COLOR AUDIO-VIDEO PRECONSTRUCTION RECORD

PART 1 - GENERAL

1.01 SCOPE

- A. Prior to commencing work, the Contractor shall have a continuous color audio-video tape recording taken along the entire length of the excavation portions of the project and at all proposed pump station sites within the project area to serve as a record of pre-construction conditions.

1.02 CONSTRUCTION SCHEDULE

- A. Tape recordings shall not be made more than 45 calendar days prior to construction. No construction shall begin prior to review and approval of the tapes covering the construction area by the Engineer. The Engineer shall have the authority to reject all or any portion of a videotape not conforming to specifications and order that it be redone at no additional charge. The Contractor shall reschedule unacceptable coverage within five (5) calendar days after being notified. The Engineer shall designate those areas, if any, to be omitted from or added to the audiovisual coverage. All tapes and written records shall become the property of Owner.

1.03 PROFESSIONAL ELECTROGRAPHERS (VIDEOGRAPHERS)

- A. The Contractor shall engage the services of a professional electrographer. The color audio-video tapes shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of preconstruction color audio-video tape documentation. The electrographer shall furnish to the Engineer a list of all equipment to be used for the audio-video taping, i.e., manufacturer's name, model number, specifications and other pertinent information. Additional information to be furnished by the electrographer is the names and address of two references that the electrographer has performed color audio-video taping for on projects of a similar nature one within the last 12 months.

PART 2 - PRODUCTS

2.01 GENERAL

- A. A total audio-video system and the procedures employed in its use shall be such as to produce a finished project that will fulfill the technical requirements of the project. The video portion of the recording shall produce bright sharp, clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection. All video recordings shall, by electronic means, display on the screen the time of day, the month, day and year of the recording. This time and date information must be continuously and simultaneously generated with the actual

recording. The audio portion of the recording shall produce the commentary of the camera operator with proper clarity and be free from distortion.

2.02 EQUIPMENT

- A. Camera: The color video camera used in the recording shall be of Industrial Grade and shall have EIA Standard NTSC type color - 1.0V 75 OHMS. Video output from camera(s) shall be capable of horizontal resolution of 350 lines at center and utilize a minimum of 8:1 Zoom with a 2/3 Newvicon tube or CCD pick-up element for optimum color imagery plus minimum lag through one foot candle.
- B. Recorder: The recording shall be made with Industrial Grade VHS recorder, utilizing EIA Standard (525 lines, 60 fields) NTSC color signal, RF Modulated 72 Db. The construction documentation shall be recorded in SP mode.
- C. Video Cassette Tape: The video cassette tape used for the recordings shall be ½", high resolution, extended still frame capable, color VHS. Tape width shall be 12.7mm and tape speed 33.35 mm/s. The video cassettes shall be new and thus shall not have been used for any previous recording.
- D. Video Tape Playback Compatibility: The recorded video tapes shall be compatible for playback with any American TV Standard VHS video cassette player.

PART 3 - EXECUTION

3.01 COVERAGE

- A. The recordings shall contain coverage of all surface features within the construction zone of influence. These features shall include, but not be limited to, all roadways, pavement, retention ponds, railroad tracks, curbs, driveways, sidewalks, culverts, headwalls, retaining walls, landscaping, trees, and fences. Of particular concern shall be the existence or non-existence of any faults, fractures or defects. Tapes coverage shall be limited to one side of the street at one time and shall include all surface conditions located within the zone of influence supported by appropriate audio description. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the object.

3.02 AUDIO RECORDING

- A. Accompanying the video recording of each video tape shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording. The audio recording shall also be free from any conversation between the camera operator and any other production technicians.

3.03 VIDEO TAPE INDEXING

- A. All video tapes shall be permanently labeled and shall be properly identified by video tape number and project title.
- B. Video Tape Log: Each video tape shall have a log of the video tapes contents. The log shall describe the various segments of coverage contained on that video tape in terms of the names of the streets or easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering stationing numbers when possible, and the date of recording.

3.04 TIME OF EXECUTION

- A. Visibility: All recording shall be performed during time of good visibility; no recording shall be done during periods of significant precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subject and to produce sharp, bright video recordings of those subjects.

3.05 CONTINUITY OF COVERAGE

- A. In order to insure the continuity of coverage, the coverage shall consist of a single continuous unedited recording which begins at one end of a particular construction area; however, where coverage is required in areas not accessible by conventional wheeled vehicles and smooth transport of the recording system is not possible, such coverage shall consist of an organized interrelated sequence of recordings at various positions along that proposed construction area e.g., wooded easement area. Such coverage shall be obtained by walking or by a special conveyance approved by the Engineer.

3.06 COVERAGE RATES

- A. The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and value of the surface features within that construction area's zone of influence.

3.07 CAMERA OPERATION

- A. Camera Height and Stability: When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed 10 feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.
- B. Camera Control: Camera pan, tilt, zoom-in and zoom-out rate shall be sufficiently controlled such that recorded objects shall be clearly viewed during video tape playback. In addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chroma, white balance and electrical focus shall be properly controlled or adjusted to maximize picture quality.
- C. Viewer Orientation Techniques: The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house

and business addresses shall be utilized. In areas where the proposed construction location will not be readily apparent to the video tape viewer, highly visible yellow flags shall be placed, by the Contractor, in such a fashion as to clearly indicate the proposed center line of construction.

END OF SECTION

DIVISION 2: SITE WORK

SECTION 02010

MOBILIZATION AND SITE WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Work included in this section includes all work necessary to transport all materials, equipment, personnel and prepare site for all well installation and wellhead construction activities for the Class I Injection Well, UZMW, and LZMW including but not limited to providing access, power, water, optional pit casing, and temporary facilities, as needed.
- B. The Class I Injection Well site will be located within the City of Sarasota Waste Water Treatment Plant site in Sarasota County, Florida.
- C. Well construction activities include but are not limited to those items described in Section 01010.
- D. Installation of pit casing (optional) in accordance with Section 15070 CASING to depth selected by the CONTRACTOR to be included in the Mobilization charges

PART 2 - PRODUCTS

2.01 GENERAL

- A. The CONTRACTOR is solely responsible for providing security for all materials stored on-site during the construction activities.
- B. The drilling pad shall be constructed in such a manner to protect the surficial aquifer from spills of saline water during construction and testing of the Class I Injection Well, UZMW, and LZMW.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contract shall provide 10 days notification to the ENGINEER prior to initiating mobilization to the site and initiating work. The CONTRACTOR will also provide proof that all permits have been obtained prior to initiating work.
- B. The CONTRACTOR shall restrict his operations to the designated work area and ensure that construction activities do not disrupt normal operational activities of the County's utility services and plant expansion construction activities.

MOBILIZATION AND SITE WORK

- C. The CONTRACTOR is responsible for visually inspecting the site to note obstructions or access difficulties.
- D. The CONTRACTOR is responsible for providing access to the work site to facilitate all well construction, inspection and testing activities. CONTRACTOR shall provide and install limestone gravel to cleared lands, existing dirt and/or paved roadways, on an as-needed basis, to maintain access for himself, ENGINEER and OWNER to the well site during the execution of the entire project.
- E. The CONTRACTOR shall coordinate with the OWNER and clear all trees, shrubs and vegetation from area surrounding the Class I Injection Well as shown in the Drawings. The cleared area shall be graded to uniform land surface elevation with the addition of soil fill material, if necessary, and approved by the ENGINEER.

PART 4 - PAYMENT

4.01 GENERAL

- A. Payment for all work, materials, equipment and personnel specified in this section including, but not limited to, pit casing installation, and gravel access roads will be included in the appropriate lump sum price amount for Mobilization as described in the Bid Tabulation.

END OF SECTION

SECTION 02110

CLEARING, GRUBBING, AND STRIPPING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work included in this Section consists of furnishing all necessary labor, equipment, material and transportation necessary to clear, grub, strip and prepare the project site for construction operations.

B. DEFINITIONS

1. Clearing: Clearing shall consist of removing and disposing of shrubs, brush, limbs, sticks, vegetative growth, trash, and rubbish. Clearing operations shall be conducted in such a manner as to protect trees, shrubs, vegetative growth, fencing, structures, and installations which are not designated for removal, and to provide for the safety of employees and others.
2. Grubbing: Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs, and any other organic or metallic debris remaining after clearing which is not suitable for site grading or foundation purposes, resting on, under, or protruding through the surface of the ground to a minimum depth of 18 inches below the subgrade.
3. Stripping: Stripping shall consist of the removal and disposal of all organics, sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. Grass and grass roots in areas to be excavated or filled upon shall be stripped to a minimum depth of 4 inches. In areas so designated, topsoil shall be stockpiled and protected until it is placed as specified. Any topsoil remaining after all work is in place, shall be stockpiled on site as shown on the Drawings and/or directed by the Engineer.

PART 2 - MATERIALS

2.01 GENERAL

- A. Trees and Shrubbery: All trees are to be preserved unless authorized by the City or their representative. Existing trees, shrubbery, and other vegetative material may not be shown on the Drawings. The Contractor shall inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. The Contractor shall preserve, in place, trees that are specifically designated to be preserved as shown on the Drawings and/or directed by the Engineer.

B. Preservation of Trees, Shrubs, and Other Plant Material:

1. All plant materials (trees, shrubbery, and plants) beyond the limits of the Work shall be saved and protected from damage resulting from the Work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these plant materials. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip-line area, no equipment will be permitted within this area.
2. When trees are close together, entry into the area within the drip line shall be restricted by fencing. In areas where no fence is erected, the trunks of all trees 2 inches in diameter or greater shall be protected by entirely encircling the trunk with boards extending from ground level to a height of 6 feet, and held securely in place by 12-gauge wire and staples. Tree branches which affect construction operations shall be cut and removed and treated with a tree sealant.

PART 3 - EXECUTION

3.01 GENERAL

- A. Disposal of Clearing and Grubbing Debris: Dispose and/or remove all cleared and grubbed material from the work site in accordance with all federal, state, and local laws, codes, and ordinances.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work to be performed under this Section shall include furnishing all equipment and labor necessary to remove storm or subsurface waters from excavation areas in accordance with the requirements set forth and as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. The dewatering of any excavation areas and the disposal of the water shall be in strict accordance with the latest revision of all federal, state, and local rules and regulations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 DEWATERING

- A. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate in the excavation.
- B. If subsurface water is encountered, the Contractor shall use suitable equipment to adequately dewater the excavation so that it will be dry for the installation of the pipes and structures. A reflective wellpoint system or dewatering method shall be used, if necessary, to maintain the excavation in a dry condition.
- C. Dewatering by trench pumping will not be permitted if migration of fine grained natural material from bottom, side walls, or bedding material will occur.
- D. In the event that satisfactory dewatering cannot be accomplished due to subsurface conditions or where dewatering could damage existing structures, the Contractor shall obtain the Engineer's approval of wet trench construction or procedure before commencing construction.

3.02 DISPOSAL

- A. Water pumped from the trench or other excavation shall be disposed of in suitable disposal pits within the boundary of the site, locations to be approved by the Engineer.

- B. The Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.
- C. In areas where adequate disposal sites are not available, partially backfilled trenches may be used for water disposal only when the Contractor's plan for trench disposal is approved, in writing, by the Engineer. The Contractor's plan shall include temporary culverts, barricades, and other protective measures to prevent damage to property or injury to any person or persons.
- D. No flooding of streets, roadways, driveways or private property will be permitted. Dewatering pump engines shall be equipped with residential-type mufflers. Where practical and feasible, electrical "drops" should be used in lieu of portable generators.

END OF SECTION

SECTION 02220

EXCAVATING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work included under this Section consists of excavating, trenching, sheeting/shoring, grading, backfilling, and compacting those soil materials required for the construction of the structures, piping, and appurtenances as shown on the Drawings and specified herein.
- B. Related Work Described Elsewhere:
 - 1. Dewatering: Section 02140
- C. Definitions:
 - 1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.
 - 2. Optimum Moisture: Percentage of water in a specific material at maximum density.
 - 3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
 - 4. Suitable: Suitable materials for fills shall be a noncohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt or muck. The Contractor shall furnish all additional fill material required.
 - 5. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M 145. Rock or other non-cushioning material encountered within the pipe trench is also considered unsuitable for bedding or backfilling.
- D. Plan For Earthwork: The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations to the Engineer for review. The Contractor shall consider, and his plan for

excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the work to be done will reflect all costs pertaining to the work. No claims for extras based on substrata or groundwater table conditions will be allowed.

1.02 QUALITY ASSURANCE

- A. A testing laboratory employed by the Contractor will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Any and all tests which have to be repeated because of the failure of the tested material to meet specifications shall be paid for by the Contractor.

1.03 JOB CONDITIONS

- A. Test borings made on the site and the surface exploration data are available upon request as stated in the Information Available to Bidders and are for the Contractor's information only.

1.04 PROTECTION

- A. Sheeting and Bracing:

1. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, power poles, etc. from undermining, and to protect workers from hazardous conditions of other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If the Owner is of the opinion that at any points sufficient or proper supports have not been provided, he may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the Owner.
2. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems if desirable for his method operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

3. Where sheeting and bracing is required to support the sides of excavations of structures, the Contractor shall engage a Professional Structural Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and certification of this shall be provided by the Professional Engineer.
4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
5. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the Owner may direct him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Owner may direct that timber used for sheeting and bracing be cut off at any specified elevation.
6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the Owner.
7. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damage to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

B. Trench Safety:

Trench excavations in excess of five (5) feet shall be subject to the Occupational Safety and Health Administration (OSHA) standards (29 C.F.R. 1926.650 Subpart P), Excavation, Trenching, and Shoring, General Protection Requirements, during the period of construction. The provisions contained therein are required by the State of Florida Trench Safety Act, October 1, 1990. Trench Safety Standards shall apply.

C. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels as stipulated in Section 02140. The Contractor shall engage a Geotechnical Engineer registered in the State of Florida, to design the dewatering systems for all structures. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and certification of this shall be provided by the Professional Engineer. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to preserve the integrity of adjacent structures. Well or sump installation shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.
5. The conveying of water in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the Owner or the authority having jurisdiction, at no cost to the Owner.
6. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be after the system is no longer required; the material and equipment constituting the system, shall be removed by the Contractor.
8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. All fill material shall be subject to the approval of the Engineer.
2. All fill material shall be free of organic material, trash, or other objectionable material. Excess or unsuitable material shall be removed from the job site by the Contractor.

B. Common Fill Material: Common fill shall be sand and shall not contain stones, rock, concrete or other rubble larger than 1/2 inch in diameter. It shall have physical properties which allow it to be easily spread and compacted. Additionally, common fill shall have no more than 12 percent by weight finer than the U.S. No. 200 mesh sieve.

C. Select Fill: Select fill shall be as specified above for common fill, except that the material shall contain no stones larger than 1/4 inch in largest dimension, and shall be no more than 5 percent by weight finer than the U.S. No. 200 mesh sieve.

D. Structural Fill: Structural fill shall be reasonably well graded sand to gravelly sand having the following gradation:

<u>U.S. Sieve Size</u>	<u>Percent Passing by Weight</u>
1 -in.	100
No. 4	75-100
No. 40	15-80
No. 100	0-30
No. 200	0-12

E. Class I Soils*: Manufactured angular, granular material, 1/4 to 1 1/2-inches (6 to 40 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C33 stone size No. 89 and with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing by Weight</u>
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 50	0-5

F. Class II Soils* **:

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
3. SW: Well-graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

* Soils defined as Class I materials are not defined in ASTM D2487.

** In accordance with ASTM D2487, less than 5 percent pass No. 200 sieve.

G. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing by Weight</u>
3/8	100
No. 10	85-100
No. 40	20-40
No. 200	0-12

H. Other Material: All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing:

1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth, within the lines of the excavation, unless otherwise noted on the plans. No clearing, grubbing, or excavating will be allowed within any jurisdictional area.

3.02 EXCAVATION

A. Excavating for Structures and Utilities:

1. Excavation shall be made to such dimensions as will give suitable room for maintenance of traffic, building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.
 - a. Pipeline: Excavation shall be to the design elevation as shown on the Drawings unless unsuitable subgrade materials are encountered at the bottom of the pipeline excavation, in which case these unsuitable materials shall be undercut and removed a minimum of 24-inches below the bottom of the pipeline and shall be replaced with compacted approved select fill before placing the pipe. All organic laden sands or debris beneath the pipe bottom level shall be completely removed from beneath the pipe and replaced with compacted approved select fill.
 - b. Excavation for precast or prefabricated structures shall be carried to an elevation 2 feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be sounded, if not dewatered, using a rigid pole to indicate to the satisfaction of the Owner that excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.
 - c. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the foundation elevation in dewatered excavation shall be replaced with 3000 psi concrete.

- d. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation. Forming for footing sides is specified elsewhere.
- 2. The Contractor shall immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.
- 3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of work.
- 4. Encounters with subsurface obstructions shall be hand excavated.
- 5. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced by crushed stone as required by the Engineer at the Contractor's expense.
- 6. The bottom of excavations shall be rendered firm and dry before placing any structure. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.
- 7. All pavements removed shall be cut with approved power tools.
- 8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
- 9. All locations and elevations as required herein must be permanently documented by the Contractor, on the Record Drawings prior to the Engineer's approval of the Application for Payment for that work.

3.03 DRAINAGE

- A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.
- B. All water pumped or drained from the work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.
- C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24 hours after being placed. The Contractor shall

constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

- D. The Contractor will be required at his expense to excavate below grade and refill with approved fill material if the Owner determines that adequate drainage has not been provided.

3.04 UNDERCUT/OVER EXCAVATION

- A. If the bottom or walls of any excavation is below or beyond that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavating method, he shall refill to normal grade with suitable fill and at his own cost. Fill material and compaction method shall be as directed by the Owner.

3.05 UTILITY BEDDING

- A. The bottom of the trench shall be shaped to provide a firm bedding for the utility pipe. The utility shall be firmly bedded in undisturbed firm soil, or handshaped unyielding material. The bedding shall be shaped so that the pipe will be in continuous contact with it for its full length and shall provide a minimum bottom segment support for the pipe equal to 0.5 of the outside diameter of the pipe.
- B. Bedding material shall be indicated on Table 02220-1. Soil unsuitable for a proper foundation encountered at or below trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required to reach suitable foundation materials. Backfilling below trench grade will in accordance with these specifications.
- C. When rock or other noncushioning material is encountered at trench grade, excavation shall be extended to six inches below the outside of the bottom of the utility, and a cushion of granular material rock shall be provided.

3.06 STABILIZATION

- A. Subgrades for concrete structures shall be firm, dense and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.
- B. Subgrades for concrete structures or trench bottoms which are otherwise solid, but which becomes mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations shown on the Drawings.
- C. All stabilization work shall be performed by and at the expense of the Contractor.

3.07 FILL AND COMPACTION

- A. Backfill material shall be clean earth fill composed of sand, clay and sand, sand and rock, crushed rock, or an approved combination thereof. Backfilling shall be divided into three specified areas: First, from trench grade to a point 12 inches above the top of the utility, called the pipe zone; secondary zone, from the top of the pipe zone to the bottom of the base course; and third zone, from the bottom of the replacement base course to the replacement surface. Where thrust blocks, encasements, or other below grade concrete works have been installed, backfilling shall not proceed until the concrete has obtained sufficient strength to support the backfill load. Compact and backfill excavations and construct embankment according to the following schedule. Backfill schedule for pipes is listed in Table 02200-1.

STRUCTURES AND ROADWORK

<u>Area</u>	<u>Material</u>	<u>Compaction</u>
Beneath Structures	Structural Fill	8" lifts, compacted to 100% standard Proctor maximum density. Fill should not be placed over any in place soils until those deposits have been compacted to 100% standard Proctor.
Around Structures	Structural Fill	8" lifts, 100% of maximum density by Proctor Standard Method. Use light rubber-tired or vibratory plate
	Common Fill	Around Manholes 8" lifts 100% maximum density.
From Cleared existing surface to subgrade for paved & gravel surfaces	Common Fill	12" lifts, 100% of Modified Proctor Method.

- B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.
- C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.
- D. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by the Owner. Embankments shall be placed in successive layers of not more than 8 inches in thickness, loose measure, for the full width of the embankment. As far as practical, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.
- E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified here, such request shall be in writing to the Owner. Approval will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Owner's approval will be in writing.

3.08 TESTING

- A. Testing for work within existing traffic zones shall be as specified in Table 02220-2.

TABLE 02220-1
BACKFILL SCHEDULE

BEDDING

Bedding, where required, should be a minimum of 6" and consist of compacted select fill or crushed stone.

PIPE ZONE (Existing and New Traffic Zones, Non-Traffic Zones)

Compacted common fill material shall be carefully placed and tamped around the lower half of the utility. Backfilling shall be carefully continued until the fill is 12 inches above the top of the utility, using the best available material from the excavation, if approved. The material shall be lowered to within two feet above the top of pipes before it is allowed to fall, unless the material is placed with approved

devices that protect the pipes from impact. The pipe zone shall exclude stones, or rock fragments larger than three inches in diameter.

SECONDARY ZONE (Existing and New Traffic Zones, Non-Traffic Zones)

The remainder of the trench, above the pipe zone and below the base course, shall be backfilled and compacted in layers not exceeding 12 inches, except that the last two lifts shall not exceed six inches per lift. Compaction of each lift shall be equal to 100% of maximum density as determined by AASHTO Specification T-99, as specified under "TESTING REQUIREMENTS", Table 02220-2.

For non-traffic zones above the pipe zone the trench must be backfilled to natural density or to 100% of AASHTO Specification T-99, whichever is greater.

COMPACTION METHODS

The specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with the exception of the first 12 inches of backfilling over the pipe shall be compacted by hand operated tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is encountered and the operation has been approved by the Engineer.

DENSITY TESTS

Density tests for determination of the above specified compaction shall be made by a testing laboratory employed by the Owner. Test locations will be determined by the Engineer, but in any case, shall be spaced not more than 200 feet apart where the trench cut is in pavements or areas to be paved. Tests shall also be made where a trench crosses a paved roadway or future paved roadway. If any test results are unsatisfactory, the Contractor shall re-excavate, recompact the backfill, and retest, at his expense until the desired compaction is obtained. Additional compaction tests shall be made to each side of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-compaction necessary.

TABLE 02220-2

EXISTING TRAFFIC ZONE TESTING REQUIREMENTS

TEST

ITEM	TEST FOR	IDENTIFICATION	DENSITY	FREQUENCY
Asphaltic Concrete	Thickness	Test lab certification At time of placement		One per crossing every 500 feet.
	Type	Extraction, gradation, stability		One per day or per crossing.
Limerock Base	Lab, Proctor	AASHTO T-180		One per each different source (including within line)
	Field Density	AASHTO T-180 Method D	100%	Each six-inch compacted lift. One per crossing or one per 400 feet.
Backfill	Lab, Proctor	AASHTO T-99 Method C/D		One per uniform material.
	Field Density	AASHTO T-99 Method C/D	100%	Each 12-inch lift beginning 12-inches above pipe, except that the last two lifts shall not exceed six-inches per lift at a spacing not to exceed 200' per pipe- line route.
Shoulder	Lab, Proctor	AASHTO T-99		One per uniform material.
	Field Density	AASHTO-T-99 Method C/D	100%	Each 12-inch compacted lift; One per 400 feet.

END OF SECTION

SECTION 02300
DEMobilIZATION

1.0 GENERAL

1.01 WORK INCLUDED

- A. This section covers the work necessary to remove from the site all personnel, supplies, equipment, and site restoration and cleanup. Demobilization shall be completed within two weeks after the completion of all other site work.

2.0 PRODUCTS

2.01 GENERAL

- A. Provide all materials and equipment required to accomplish the work as specified.
- B. On all questions concerning the acceptability of materials, execution of work, determination of costs, the decision of the ENGINEER shall be final and binding upon parties.
- C. The CONTRACTOR shall assume full responsibility for all supplies, materials, and equipment required by it for the contracted work, whether furnished by itself or other parties.

3.0 EXECUTION

3.01 GENERAL

- A. Accomplish all required work in accordance with the applicable portions of these Specifications and Parts or as approved by the ENGINEER.
- B. The replacement of minor obstructions and restoration of physical features, even though not shown or specifically mentioned shall be anticipated and accomplished.
- C. Upon leaving the site at the completion of the work, the CONTRACTOR shall clean equipment and materials of surface and subsurface materials contacted at the site.

3.02 CLEANUP OF CONSTRUCTION AREAS

- A. Avoid defacing of the site area. Do not dump waste oil, fuel, rubbish, or other materials on the ground. Restore the site to condition approved by the ENGINEER.

- B. Replace or repair any facility, equipment, buildings, fencing, etc. damaged during work. Site cleanup shall be completed to the satisfaction of the ENGINEER. Solid waste such as subsurface fluids shall be contained so that it shall not migrate from the site or areas designated by the ENGINEER. This includes drill cuttings and debris such as wood, pipe, and hose. These materials shall be segregated and identified and removed and disposed of offsite, as approved by the ENGINEER.

4.0 PAYMENT

4.01 GENERAL

- A. Payment for all work, materials, and equipment specified in this section shall be at the lump sum unit price as stated in the CONTRACTORS bid for DEMOBILIZATION. Payment shall only be made once for the site, and shall be for clean up and removal of equipment.
- B. A project closeout meeting is mandatory at the site following CONTRACTORS completion of Demobilization. Cost for this shall be included in the CONTRACTOR'S Bid for DEMOBILIZATION.

END OF SECTION

SECTION 02500
STANDBY TIME

1.0 GENERAL

1.1 DEFINITIONS:

- 1.1.1 Standby time is shutdown time of the equipment and crew for any portion of the normal working day (7:00 a.m. to 7:00 p.m., Monday through Friday) when the OWNER or ENGINEER orders work to cease or when other activities at the site preclude work by the CONTRACTOR, as approved by the ENGINEER.
- 1.1.2 Standby time does not include well testing time or time when the ENGINEER'S representative or a regulatory agency or other authority orders work to cease because of safety, lack of proper equipment or supplies, or violation of federal, state, or local rules, regulations, or statute.

2.0 PAYMENT

2.1 GENERAL

- 2.1.1 Payment for standby time (resulting from each cause approved by the ENGINEER) shall be at the unit price per hour, to the nearest half-hour per day, as stated in the Contractors Bid for STANDBY TIME.

END OF SECTION

SECTION 02640

VALVES AND ACCESSORIES

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

- A. The Contractor shall furnish and install all gate valves, butterfly valves, plug valves, check valves, and other special valves and piping accessories as shown on the drawings and as specified herein.
- B. Valve input shaft shall be furnished with a two (2) inch square AWWA operating nut with an arrow cast on to show the direction of turning to close the valve.
- C. Extension shaft as manufactured by the valve manufacturer shall be provided to place the operating nut between six (6) inches and eighteen (18) inches below proposed grade along with stainless steel centering plate.
- D. Contractor shall install a brass disk within the valve pad according to standard detail.

1.02 SUBMITTALS

- A. The Contractor shall submit:
 - 1. Shop drawings or manufacturer's product data on all items in PART 2.
 - 2. One (1) original certified test report and two (2) copies of the test reports. Certification shall include all test results required by AWWA. The test shall include but not be limited to the following: Hydrostatic and leakage tests conducted in accordance with AWWA C504, Section 12.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. All valve operators shall be designed as not to require over 80 pounds pull to meet the required torque to operate the valves.
- B. All manually operated, shut-off or isolation valves, above grade, shall be furnished with handwheel or lever operators.
- C. All manually operated, shut-off or isolation valves that are mounted over six (6) feet

VALVES AND ACCESSORIES

above finish floor elevations shall be furnished with chain wheel operators. Chain for chain wheel operators shall be galvanized or stainless steel.

- D. All manually operated, shut-off or isolation valves, below grade, shall be furnished with AWWA 2" square actuating nuts and valve boxes. Valve boxes shall consist of cast iron base and adjustable top section with cover which shall be marked for the appropriate service, i.e. "WATER", "SEWER", "REUSE", ETC.
- E. Where called for on the drawings, electric valve actuators shall be provided. The electric actuators shall be powered by a high torque, reversible motor with integral thermal overload protection. The gear train shall be heat treated high alloy steel and shall be sized to withstand all imposed valve torque loads. The gear train shall be permanently lubricated. The actuator shall be furnished with a manual override capable of preventing electrical operation of the actuator when the override is engaged. The actuator, complete with integral positioner, shall be housed in a NEMA 4 enclosure and shall operate on 120 VAC, 1-phase, 60 Hz power supply.
- F. All valves shall open by turning to the left or counter-clockwise when viewed from the stem. The operating nut shall have an arrow cast in the metal indicating the direction of opening. Each valve shall have the manufacturer's distinctive marking, pressure rating and year of manufacture cast on the body. All valves shall be tested in accordance with applicable AWWA pressure testing procedures.
- G. All valves shall be corrosion protected in accordance with Section 2614 of this document.

2.02 GATE VALVES

- A. Resilient seat gate valves shall be ductile iron bodied, bronze mounted, resilient rubber seated with wedge type disk. Valves shall be manufactured in accordance with AWWA C515. Valves shall be suitable for buried service, be designed for 200 psi working pressure, shall be of O-ring type, and shall have a permanently lubricated thrust collar sealed with an O-ring above and below. Valves shall have mechanical joint ends, except above ground valves shall be flanged. Valves shall be coated in accordance with AWWA C550, as manufactured by American Flow Control, Mueller, McWane, or U.S. Pipe and Foundry. No substitutions allowed.

2.03 BUTTERFLY VALVES

- A. Butterfly Valves (for liquid service):
 - 1. Butterfly valves shall conform to AWWA C504. Laying length of all classes shall be Table 1 (AWWA C504), short body. Valves shall be rated at 150 psi working pressure. Valves shall be bubble tight at rated pressures and

VALVES AND ACCESSORIES

shall be satisfactory for applications involving valve operation after long periods of inactivity. Valves shall have mechanical joint ends for buried service and flanged joints in the vaults and above grade. Butterfly valves shall be as manufactured by Pratt, Mueller, U.S. Pipe and Foundry, or McWane. No substitutions allowed.

2. Valve body shall be ductile iron per AWWA C-504 with integrally cast hubs for shaft bearing housing. All exterior bolts, nuts, studs, and washers, including mechanical joint bolting accessories, shall be stainless steel.
3. The valve disc shall be of heat treated ductile iron, cast iron or alloy cast iron per ASTM A126, Class B, with a 316 SST edge. All materials shall meet AWWA C-504. The disc shall rotate 90 degrees from full open to tight shut position. The contractor shall verify clearance dimensions required for the valve disc to be compatible with the pipe.
4. Valve shaft shall be of a solid one-piece design or stub shaft. Shaft, taper pins, lockwashers and nuts shall be Type 304 or 316 stainless steel. A shaft seal and bronze gland follower, studs and nuts shall be provided in the valve body. Shaft seals shall be in accordance with Section AWWA C-504 for Class 150B, of the O-ring or split "V" type, suitable for buried service.
5. Valve seat shall be of molded natural or synthetic rubber, recess mounted, bonded to the valve body. All mechanical securing devices shall be stainless steel. Seats shall not be located on the disc.
6. Valves shall be fitted with sleeve type bearings of self-lubricating corrosion resistant material.
7. Valve operators shall be in accordance with AWWA C504 and for buried service shall be permanently lubricated with totally enclosed gearing and designed to operate indefinitely either buried or fully submerged. All operator components between the input and stop limit shall be designed to withstand, without damage, a pull of 200 pounds for handwheel or chain wheel operators and an input torque of 300 foot pounds for operating nuts. Operators shall be designed to require not over 150 foot pounds to meet the required operating torque. Operators shall be designed to hold the valve disc in any intermediate position between fully closed and fully open without creeping or fluttering.
8. All valves shall receive a protective inside lining. The lining shall be a two-part thermosetting epoxy protective lining and shall function as a physical, chemical and electrical barrier between the base metal to which it is applied and the surroundings. The lining shall be approved by both AWWA and

VALVES AND ACCESSORIES

NSF61. The lining shall be nontoxic and shall not impart taste to water. The lining must be formulated from materials deemed acceptable per the FOOD AND DRUG ADMINISTRATION DOCUMENT TITLE 21 of the FEDERAL REGULATIONS ON FOOD ADDITIVES, SECTION 121.2514 entitled, RESINS AND POLYMERIC COATINGS.

2.04 CHECK VALVES

A. General:

1. Check valves shall be installed where shown on the drawings.

B. Swing Check Valves:

1. Check valves three (3) inches and larger shall be horizontal swing check valves of the iron body bronze mounted, full opening type. Check valves shall be in accordance with AWWA C508 and equipped with outside levers and weights. Check valves smaller than three (3) inches shall be bronze, suitable for the service required.
2. Swing check valves shall be used at all locations where a specific type of check valve is not specified or noted on the drawings. Swing check valves shall be American Flow Control, McWane, Mueller, or U.S. Pipe and Foundry. No substitutions allowed.
3. Limit Switches: Limit switches shall be provided on check valve swing arms. Switches shall be roller lever rotary actuated type, with contacts rated for 10 amp at 120 VAC. Switches shall be located to actuate when the check valve is fully closed and deactivate when the valve begins to open. Switches shall be **Honeywell Microswitch Model 1LS1, Square D 9007 C**, or equal.

C. Rubber Flapper Check Valves:

1. Check valves shall be rubber flapper swing check valves of long pattern design (not wafer). Check valves shall have a heavy ductile iron body. Cover, bolts, nuts, and washers shall be 304SS; flange gaskets shall be rubber. Flapper shall be Buna-N with an O-ring seating edge, an elastic spring, molded internally, and shall be reinforced with steel. The flapper shall be easily removed from the check valve without needing to remove the valve from the line. Check valves will have full pipe size flow area. Check valves shall be APCO, Val-Matic, or Crispin rubber flapper swing check valves. No substitutions allowed.

VALVES AND ACCESSORIES

2.05 PVC BALL VALVES

- A. Ball valves shall be the true union types, PVC (rigid, unplasticized, Type 1, polyvinyl chloride). PVC Ball Valves shall be of the full port area type with Teflon seat and "T" handle manufactured by Hayward Manufacturing Co., Inc., or equal, as per AWWA 507.

2.06 PLUG VALVES

- A. Plug valves shall be of the non-lubricated eccentric round port design. Valves shall be designed for a working pressure of 175 psi through twelve (12) inches and 150 psi for fourteen (14) inches and larger. Plug valves shall be Pratt or Milliken. No substitutions allowed.
- B. Plug valves up through twenty-four (24) inches shall have a round port. Plug valves thirty (30) inches and larger may have a rectangular port.
- C. The valve plug shall be constructed of cast iron ASTM A126, Class B, with Buna-N resilient seating surface to mate with the body seat.
- D. Plug valves shall be furnished with permanently lubricated grit excluder seals shall be provided to isolate the bearings.
- E. Plug valve shaft seals shall be the self adjusting type. All packing shall be replaceable without removing the valve bonnet.
- F. Each valve shall be given a test against the seat at the full rated working pressure and a hydrostatic shell test at twice the rated working pressure. Certified copies of individual tests shall be submitted when requested. Certified copies of proof-of-design tests shall be submitted upon request.
- G. Manual valves shall have a worm gear type actuator with handwheels, two (2) inch square nuts, chainwheels attached. Worm gear type actuators shall be furnished on all six (6) inches or larger valves where the maximum unseating pressure is 25 psig or more.
- H. All valves shall receive a protective inside lining. The lining shall be a two-part thermosetting epoxy protective coating Amerlock 400 or equal and shall function as a physical, chemical and electrical barrier between the base metal to which it is applied and the surroundings.

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2.07 REDUCED PRESSURE DEVICE

- A. Reduced pressure devices shall be furnished and installed according to the latest revision to the Sarasota County Cross Connection Control Ordinance.

2.08 FLANGED COUPLING ADAPTERS

- A. Flanged coupling adapters shall be used for joining plain end pipe to flanged valves, pumps, and fittings located as shown on the drawings and/or as required. The adapters shall be equipped with anchor studs designed to withstand the end thrust of the piping. Harnessing shall be provided on sizes above twelve (12) inches.
 - 1. The flanged adapters shall be fabricated steel, Rockwell International Type 913, Baker Type 602, or Dresser Type 128. No substitutions allowed.

2.09 WATER AIR RELEASE VALVES

- A. Air release valves shall be two (2) inches in size, and meet NSF 61 and/or AWWA C512. Water air release valves shall be manufactured by A.R.I. Model D-040 reinforced nylon body combination air valve, or Val-Matic Single Body Model 202C.2 cast iron body combination air valve. All valves must be ISO-9000 certified and NSF 61 Compliant. No other substitutions will be allowed.
- B. Valves shall be rated at 200 psi, and factory tested at 300 psi. Test results shall be supplied to Utilities upon request.
- C. Valve Construction:
 - 1. The combination air valve shall be designed to allow large quantities of air to escape out the orifice when the water line is being charged and close water-tight when liquid enters the valve. The air valve shall also permit large quantities of air to re-enter through the orifice to prevent a vacuum from forming in the water line. The minimum size discharge nozzle shall be one and one half (1-1/2) inch diameter. Inlet connection shall be male or female 2" NPT.
 - 2. The A.R.I. valve shall consist of a reinforced nylon body, seal plug assembly, float and base. The seal plug assembly shall be attached to the body of the air release valve by a reinforced nylon clamping stem that slides in preformed grooves of the body. The body/base assembly shall be capable of being unscrewed for easy maintenance.
 - 3. Except for the resilient seal member, all internal components of the Val-

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Matic valve shall be constructed of type 316 stainless steel.

4. Materials:

	A.R.I.	Val-Matic
Body Base	Reinforced Nylon	Cast Iron ASTM A126
Float	Foamed Polypropylene	316 Stainless Steel
Seat	EPDM	EPDM
Hardware	SAE 316 Stainless Steel	SAE 316 Stainless Stl.
Coating/Color	None/Blue Outlet	Universal Alkyd (Blue)

5. Connection to the waterline shall be constructed as indicated on the Sarasota County Standard Detail entitled "Automatic Air Release Valve", Water Dwg. No. 3.

All valves shall be installed in accordance with manufacturer's recommendations, and shall have a brass ball valve(s) constructed upstream of the air release valve.

6. Above Ground Enclosure:

All air release valves shall be enclosed in a 16" Wide X 13" Deep X 32" High above ground enclosure. Enclosures shall consist of high quality, UV resistant molded high impact resistant polyethylene poly-plastic construction with stainless steel hardware and galvanized steel mounting stakes. All enclosures shall be dark blue in color for potable water and shall be equipped with a Pin Allen lock and key.

The word "WATER" shall be embossed on the enclosure, visible at roadside. A Pin Allen key shall be provided with each installation. Enclosures shall be supplied by Water Plus Corporation, Model # 131632, Color: DARK BLUE.

2.10 WASTEWATER & RE-USE WATER AIR RELEASE VALVES

- A. Air release valves shall be two (2) inches in size. Wastewater & Re-use Water air release valves shall be manufactured by A.R.I. Model D-025 reinforced nylon body combination air valve. Valves must be ISO-9000 certified. No substitutions will be allowed.
- B. Valves shall be rated at 150 psi, and factory tested at 230 psi. Test results shall be supplied to Utilities upon request.
- C. Valve Construction:

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1. The combination air valve shall be specifically designed to operate with liquids carrying solid particles, and allow large quantities of air to escape out the orifice when the pipeline is being charged and close water-tight when liquid enters the valve. The combination valve shall also permit large quantities of air to re-enter through the orifice to prevent a vacuum from forming in the pipeline. The valve shall have a two (2) inch male N.P.T. inlet and a one and one-half (1-1/2) inch male Kamlok discharge. All valves shall be installed in accordance with manufacturer's recommendations, and shall have isolation valve connections for control.
2. The A.R.I. valve shall be conical in shape, and consist of a reinforced nylon body, seal plug assembly, float and base. The valve design and operation shall not allow contact between the sewage or re-use water and the sealing mechanism by providing an air gap at the top of the valve. The seal plug assembly shall be attached to the body of the air release valve by a reinforced nylon clamping stem that slides in preformed grooves of the body. The body/base seal shall consist of a BUNA-N O-Ring Gasket and SAE 316 Stainless Steel clamp which can be disassembled for easy maintenance.
3. Air release valves shall also be furnished with a one half (1/2) inch outlet drain plug.
4. Materials:

Body Base	Reinforced Nylon
Float	Foamed Polypropylene
Seat	EPDM
Interior Components	SAE 316 Stainless Steel
Exterior Hardware	SAE 316 Stainless Steel
Coating/Color	Green Flushing Connection (Sewer)
	Pantone Purple Flushing Connection (Re-Use)
5. Wherever possible, above grade air release valves for wastewater and re-use water lines shall be designed and installed. Connection to the wastewater line, or re-use water line, shall be constructed as indicated on the Sarasota County Standard Detail entitled "Automatic Air Release Valve", Water Dwg. No. 3, as modified herein.
6. Where underground installations of wastewater and re-use water air release valves are required, connection to the lines shall be constructed as indicated on the Sarasota County Standard Detail entitled "Automatic Air Release Valve", Sewer Dwg. No. 15, as modified herein.
Specific Drawing Modifications: 1) Pre-Cast Concrete Manhole shall be 5' minimum diameter, and 2) eliminate fill inside of manhole.

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7. Above Ground Enclosures:

All above grade air release valves shall be enclosed in a 16" Wide X 13" Deep X 32" High above ground enclosure. Enclosures shall consist of high quality, UV resistant molded high impact resistant polyethylene poly-plastic construction with stainless steel hardware and galvanized steel mounting stakes. All enclosures shall be equipped with a Pin Allen lock and key.

The word "SEWER" shall be embossed on the wastewater line enclosure, visible at roadside. A Pin Allen key shall be provided with each installation. Enclosures shall be supplied by Water Plus Corporation, Model # 131632, Color: STANDARD MEDIUM GREEN.

The word "RE-USE" shall be embossed on the wastewater line enclosure, visible at roadside. A Pin Allen key shall be provided with each installation. Enclosures shall be supplied by Water Plus Corporation, Model # 131632, Color: GRAY.

2.11 PRESSURE SUSTAINING VALVES

- A. This valve shall maintain a constant upstream pressure regardless of fluctuations in the demand, and shall also close tight when pressure reversal occurs.
- B. The main valve shall be a hydraulically operated, diaphragm-actuated, globe or angle pattern valve. It shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly containing a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing valve from the line.
- C. The pilot control shall be a direct-acting, adjustable spring-loaded, diaphragm valve, designed to permit flow when controlling pressure exceeds the spring setting.
- D. When downstream pressure exceeds the inlet pressure, the valve shall close tight to prevent reverse flow.
- E. Valve shall be similar in all respects to the CLAYTON 51-01 COMBINATION PRESSURE SUSTAINING AND CHECK VALVE as manufactured by Cla-Val,

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Bermad, or equal.

- F. Provide pressure gauges upstream and downstream of the valve.

2.12 FLOW CONTROL VALVES

- A. This valve shall be installed to electronically open and ramp closed slowly to control flow going back into the well. This will be accomplished through a set of solenoids in the pilot system. It will have two normally closed solenoids energized to open powered by a controller. This controller will accept a flow signal, process variable from the meter. It will compare the flow signal with the set point and position the valve to the desired rate.
- B. The main valve will be diaphragm actuated and consist of three components; the body, cover and diaphragm assembly. It will be stainless steel and have stainless trim and cover bolts unless indicated otherwise on the drawings. The seat will be a one piece solid stainless steel. The solenoids, tubing and fittings will also be of stainless steel unless indicated otherwise on the drawings. The cover will have a locating lip for ease of maintenance. There shall be no pinned covers for alignment. The diaphragm assembly shall be fully guided by a bearing in the seat and a bearing in the valve cover. The main valve will have a single diaphragm, which separates line pressure from the operating chamber in the cover.
- C. The pilot system will consist of two solenoids, one for opening and one for closing. They will be actuated by the electronic controller mounted in a stainless steel panel. The controller is 120vac and will be set to have a ramp feature to slowly open and close to isolate the systems. It will accept either a remote 4-20ma signal or a digital dry contact closure to open or close the valve from the SCADA system. It will compare this signal to the valve position and open or close. The valve position signal can be monitored by a valve position indicator. In the case of a power outage, the valve solenoids can be set to open or close valve.
- D. The manufacturer shall provide a direct factory employee for start up services and training as required by Sarasota County. The manufacturer shall warranty the valve for 3 years from date of shipment and be manufactured by Cla-Val, Ames, or approved equal.

2.13 VALVE BOXES

- A. Valve boxes shall be the five and one quarter (5-1/4) inches standard cast iron two-piece, screw type valve box with drop cover marker "WATER." The marker shall denote type of service, i.e. WATER, SEWER, RAW, REUSE, etc. They shall be of sufficient height to allow them to be raised an additional two (2) inches above the

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final elevation at each location that a valve is required on this project. PVC sleeves will not be allowed. Valve boxes shall be manufactured in the United States of America.

2.14 SLEEVES

- A. Sleeves shall be cast iron, and of the size and in the location shown on the drawings. Sleeves shall comply with section 2610 of this document.

END OF SECTION

VALVES AND ACCESSORIES

SECTION 02934

SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work specified in this section consists of establishing a stand of grass where existing sod is disturbed during construction, by furnishing and placing grass sod. Also included are fertilizing, watering and maintenance as required to assure a healthy stand of grass.

1.02 SUBMITTALS

- A. A certification of sod quality by the producer shall be delivered to the Engineer ten days prior to use.

PART 2 - PRODUCTS

2.01 GRASS SOD

- A. Grass sod shall be similar to that damaged or removed and shall be well matted with grass roots. The sod shall be taken in rectangles, preferably 12 inch by 24 inch, shall be a minimum 2 inches in thickness and shall be live, fresh and uninjured at the time of planting.
- B. It shall be reasonably free of weeds and other grasses and shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.02 FERTILIZER

- A. Commercial fertilizer shall comply with the state fertilizer laws.
- B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water-soluble potash contained in the fertilizer.
- C. The chemical designation of the fertilizer shall be 6-6-6. At least 50 percent of the nitrogen shall be derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a

minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

2.03 WATER FOR GRASSING

- A. The water used in the sodding operations shall be obtained as provided for in Division 1.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

- A. The area over which the sod is to be placed shall be scarified or loosened to a depth and then raked smooth and free from debris. Where the soil is sufficiently loose and clean, the Engineer, at his discretion, may authorize the elimination of ground preparation.

3.02 APPLICATION OF FERTILIZER

- A. Before applying fertilizer, the soil pH shall be brought to a range of 6.0 - 7.0.
- B. The fertilizer shall be spread uniformly over the area to be sodded at the rate of 700 pounds per acre, or 16 pounds per 1,000 square feet, by a spreading device capable of uniformly distributing the material at the specified rate. Immediately after spreading, the fertilizer shall be mixed with the soil to a depth of approximately 4 inches.
- C. On steep slopes, where the use of a machine for spreading or mixing is not practicable, the fertilizer shall be spread by hand and raked in and thoroughly mixed with the soil to a depth of approximately 2 inches.

3.03 PLACING SOD

- A. The sod shall be placed on the prepared surface, with edges in close contact and shall be firmly and smoothly embedded by light tamping with appropriate tools.
- B. Where sodding is used in drainage ditches, or on slopes of 4:1 or greater, the setting of the pieces shall be staggered so as to avoid a continuous seam along the line of low. Along the edges of such staggered areas, the offsets of individual strips shall not exceed 6 inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.
- C. On slopes greater than 2:1, the Contractor shall, if necessary, prevent the sod from sliding by means of wooden pegs driven through the sod blocks into firm earth, at suitable intervals.
- D. Sod which has been cut for more than 72 hours shall not be used unless specifically authorized by the Engineer after his inspection thereof. Sod which is not planted within 24

hours after cutting shall be stacked in an approved manner and maintained and properly moistened. Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.

- E. Sodding shall not be performed when weather and soil conditions are, in the Engineer's opinion, unsuitable for proper results.

3.04 WATERING

- A. The areas on which the sod is to be placed shall contain sufficient moisture, as determined by the Engineer, for optimum results. After being placed, the sod shall be kept in a moist condition to the full depth of the rooting zone for at least 2 weeks. Thereafter, the Contractor shall apply water as needed until the sod roots and starts to grow for a minimum of 60 days (or until final acceptance, whichever is latest).

3.05 MAINTENANCE

- A. The Contractor shall, at his expense, maintain the sodded areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include repairing of any damaged areas and replacing areas in which the establishment of the grass stand does not appear to be developing satisfactorily.
- B. Replanting or repair necessary due to the Contractor's negligence, carelessness or failure to provide routine maintenance shall be at the Contractor's expense.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide formwork for cast-in-place concrete.

1.02 RELATED WORK

- A. Section 03200, Concrete Reinforcement
- B. Section 03250, Concrete Accessories
- C. Section 03300, Cast-In-Place Concrete

1.03 QUALITY ASSURANCE

- A. Standards:
 - 1. Standard Building Code
 - 2. ACI 347, Recommended Practice for Concrete Formwork.
 - 3. Local codes and regulations.
- B. Contractor's Responsibility: For design of the formwork and for safety in its construction, use and removal.
- C. Tolerances: Construct formwork to insure that finished concrete surfaces will be in accordance with the tolerances listed in ACI 347. Provide camber as necessary to compensate for anticipated deflection in formwork and concrete due to weight and pressure of fresh concrete and other construction loads.

1.04 SUBMITTALS

- A. Submit in accordance with Sections 01300 and 01340, product data and other manufacturer's literature on form ties, spreaders, corner formers, form coatings and bond breakers.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lumber: Douglas Fir or Larch, No. 2 grade, seasoned and surfaced on four sides.
- B. Plywood: Plyform, Class I, BB-Exterior type, mill oiled and edge sealed, with thickness not less than 3/4-inch.
- C. Medium Density Overlay (MDO) Plywood Forms: PS-1, B-B High Density Concrete Form Overlay, Class I, unoiled.
 - 1. Butt form panels, make contact surface fully flush and seal butting holes with sponge form tape. Chamfer edges of beams and ceilings.
 - 2. Where MDO plywood is used to form beams, use no piece of MDO plywood that has been patched or damaged.
- D. Drip Forms: Varnished ponderosa pine or equally rigid non-staining plastic, 1/2 inch wide on each leg.
- E. Steel Forms: Uncoated steel, 3/16 inch minimum thickness, fabricated to close tolerances, protected only by the specified release agent, braced so as not to bend, dent or dimple under wet concrete loads, vibrator impact, and tool impact. Maintain steel forms in rust-free condition by use of steel wool and light grinding, followed by coats of specified release agent. Use forms that can be adjusted into true alignment without stops or ridges.
- F. Glass Fiber Reinforced Plastic (FRP) Forms: Smooth coated forms, braced so as not to bend, dent or dimple under wet concrete loads, vibrator impact and tool impact, and at least 0.11 inch thick. Design forms for external bracing at piers and columns, without use of form ties.
- G. Plugged Cone Form Ties: Rod type, with ends or end fasteners which can be removed without spalling the concrete and which leave a hole equal in depth to the required reinforcement clearance. Form ties shall be of a design in which the hole left by the removed end or end fastener is easily filled to match the surface of the hardened concrete. Provide removable cones 1 1/4 inches in diameter by 1 1/2 inches deep. Provide preformed mortar plugs to match the color of the concrete, recessed 1/4 inch, adhered with an approved two part epoxy.
- H. Weep Hole Forms: PVC, polyethylene, or ABS pipe, matching color of the concrete, 4 inch inside diameter, with outlet projecting 1 1/2 inches from wall and cutoff in a plane parallel to it.

- I. Beam Forms: Provide in one length without form joints and suitable for cambering up to 1/160 of span without distortion of profile or opening of seams.
- J. Control Joint Filler: Use epoxy joint filler equal to BurkEpoxy Joint Filler to fill voids left by saw cuts and to resist against spalling caused by vehicle traffic in concrete slabs.
- K. Inserts: Galvanized cast steel or galvanized welded steel, complete with anchors to concrete and fittings such as bolts, wedges and straps. Provide hanger inserts spaced to match grid of suspended ceilings.
- L. Shoring: As designed and executed by Contractor to support all loads.
- M. Chamfer Strips: Polyvinyl strips designed to be nailed in the forms to provide a 3/4-inch chamfer at all exposed edges of concrete members.
- N. Form Release Agent: A blend of natural and synthetic chemicals that employs a chemical reaction to provide quick, easy and clean release of concrete from forms, and equal to Eucoslip, by the Euclid Chemical Company, or Release #1, by The Burke Company. Use a non-staining release agent that leaves the concrete with a paintable surface.

PART 3 - EXECUTION

3.01 DESIGN

- A. Contractor's Responsibility: The design, engineering, and construction of the formwork.
- B. Design watertight formwork in accordance with ACI 347 Chapter 1, to withstand the pressure resulting from the placement and vibration of the concrete, and which is sufficiently hard and rigid to resist indentation and scratching while maintaining tolerances, and with maximum deflection between form supports of 1/240 span length.

3.02 INSTALLATION/ERECTION

- A. Construction Of Formwork: Construct forms sufficiently strong to withstand the pressure resulting from the placement and vibration of concrete, sufficiently rigid to maintain specified tolerances, and sufficiently tight to prevent loss of mortar. Brace forms against lateral, upward or downward movement.

- B. Form Facing Materials: Use form facing materials that produce a hard uniform texture on the concrete. Do not use facing materials with raised grain, torn surfaces, worn edges, patches, dents or other defects. Use facing materials with maximum deflection, as reflected in concrete surfaces not in excess of 1/240 of the span between structural members. Prevent formation of ridges, fins, offsets, or similar surface defects of finished concrete.
- C. Preparation Of Form Surfaces: After each use and prior to placing reinforcing, clean forms of mortar, grout and other foreign material and apply the form release agent. Do not allow the form release agent to stand in puddles in the forms, to come in contact with hardened concrete against which fresh concrete is to be placed, or with reinforcing steel and items to be embedded. Reuse only forms which maintain a uniform surface texture on exposed concrete surfaces. Apply light sanding between uses to obtain such uniform texture. Plug unused tie rod holes with corks, shave flush and sandpaper on the concrete surface side.
- D. Adjustment: Provide positive means of adjustment of shores and struts to take up all settlement during concrete placing.
- E. Temporary Openings: Provide temporary openings in wall forms to limit the free fall of concrete to a maximum of 6-feet unless an elephant trunk is used. Locate such openings to facilitate placing and consolidation, and space no more than 8-feet apart. Provide temporary openings in the bottom of wall and column forms and elsewhere as necessary to facilitate cleaning and observation immediately prior to placing.
- F. Construction Joints: At construction joints, overlap the contact surfaces of the form sheathing over the hardened concrete by not more than 1-inch. Hold forms against the hardened concrete to prevent offsets or loss of mortar.
- G. Chamfers: Provide chamfers at all exposed edges of concrete members.
- H. Do not embed any form-tying device or part thereof other than metal in concrete.
- I. Form all surfaces of concrete members except where placing concrete against ground. Dimensions of concrete members shown on Drawings apply to formed surfaces, except where otherwise indicated. Add at least 2 inches of concrete where concrete is placed against trimmed undisturbed ground in lieu of forms. Limit placement of concrete against ground to footings and then only where ground can be trimmed to required lines and will stand securely without caving or sloughing.
- J. Runways: Provide smooth and rigid runways (if needed) for moving equipment and concrete. Support runways directly on formwork or on grade and in no case on reinforcing steel or bar supports.

- K. Embedded Items: Set anchor bolts and other embedded items accurately and hold securely in position in the forms until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check all nailing, blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to concreting. Coordinate with other trades for items to be embedded in the concrete and not shown on Structural Drawings.
- L. Pipes and Wall Spools Cast in Concrete:
1. Install wall spools, wall flanges and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools to the reinforcing steel.
 2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during construction.
- M. Form Tolerances:
1. Tolerances or allowable variations from dimensions or positions of structural concrete work:

a. Sleeves and Inserts	+1/4" to -1/4"
b. Projected ends of anchors	+1/4" to -0.0"
c. Anchor bolt setting	+1/4" to -1/4"
d. Finished concrete, all locations	+1/4" to -1/4"
	in 10 feet of length
 2. Planes or axes from which above tolerances are measured:

Sleeves and Inserts	Centerline of sleeve or insert
Projected ends of anchors	Plane perpendicular to end of anchor
Anchor bolt setting	Centerline of anchor bolt
Finish concrete	Concrete surface
 3. Comply with equipment manufacturer's tolerances if more severe than above.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide steel reinforcement for cast-in-place and precast concrete structures.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork
- B. Section 03250, Concrete Accessories
- C. Section 03300, Cast-In-Place Concrete

1.03 QUALITY ASSURANCE

- A. Standards:
 - 1. Standard Building Code.
 - 2. ACI 315, Details and Detailing of Concrete Reinforcement.
 - 3. ACI 318, Building Code Requirements for Reinforced Concrete.
 - 4. CRSI Manual of Standard Practice, MSP-1.
 - 5. Local codes and regulations.

1.04 SUBMITTALS

- A. Submit in accordance with Sections 01300 and 01340, the following:
 - 1. Mill test certificates identifying chemical and physical analyses for each load of reinforcing steel delivered.
 - 2. Bending lists and placing drawings for reinforcement. Indicate openings (mechanical, electrical, equipment), including additional reinforcing at openings and intersecting wall, beam and footing arrangements. Coordinate placing drawings with concrete placing schedule. Submit complete bending lists and placing drawings

together for each element of structure (grade slabs, footings, walls, deck, floor or roof slabs), including all dowels and other bars.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship reinforcement with bars of same size and shape fastened in bundles with metal identification tags giving size and mark securely wired on. Label identification tags with same designation as shown on bar lists and shop drawings.
- B. Store bars off ground. Protect from moisture and keep free from dirt, oil and injurious contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed bars of a USA manufacture.
- B. Welded Wire Fabric: ASTM A185, gauges, spacing and dimensions as indicated.
- C. Metal Bar Supports: CRSI MSP-1, Chapter 3, Class 2, Type B, Stainless Steel Protected Bar Supports, or as otherwise approved by the Engineer. Use concrete supports for reinforcement in concrete placed on grade.
- D. Tie Wire: 16 gauge minimum, black, soft annealed.
- E. Coupler Splice Devices: Cadweld tension couplers, capable of developing the ultimate strength of the bar as manufactured by Erico Products, Incorporated, Solon, Ohio, or equal.

2.02 FABRICATION

- A. Do not commence fabrication until receipt of the shop drawings approval. Fabricate reinforcing steel in accordance with all requirements of the specified standards and within CRSI tolerances, and unless otherwise indicated, with the following:
 - 1. Provide standard hooks.
 - 2. Extend bottom bars a minimum of 6-inches into supporting members.
 - 3. Provide cover indicated to the outermost stirrup, tie or bar.
 - 4. Provide splices only where indicated on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Before placing, clean reinforcement of loose mill scale and rust, dirt and other coatings and contaminants that reduce or destroy bond.
- B. Supporting Reinforcement: Provide bar supports as required by CRSI MSP-1. Support top and bottom bars in slabs formed on earth on precast concrete block supports except where such bars are properly supported from formwork. Precast concrete block supports are not required in slabs formed on tremie concrete but may be used at the Contractor's option.
- C. Placing Reinforcement: Place reinforcing bars and welded wire fabric as indicated on the Drawings and as recommended by CRSI MSP-1 and ACI 315. Securely tie and support reinforcement to prevent displacement during concrete placement.
- D. Welded Wire Fabric: Splice welded wire fabric such that the overlap between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires, plus 2-inches. Do not extend fabric through expansion joints or construction joints in slabs on grade except as otherwise indicated.
- E. Where splices are indicated on the Drawings, splice bars in slabs, beams and girders according to ACI 315. Unless otherwise shown on Drawings, lap splices in reinforcement not less than 30 bar diameters. Splice horizontal bars in circular structures 40 bar diameters. Provide splices and laps in columns, piers and struts in a manner sufficient to transfer full stress bond. When splicing bars of different diameters, length of lap is based on larger bar. Stagger splices in adjacent bars.
- F. Coupler Splice: Unless indicated on the Drawings, provide full positive tension connections. Install such devices in accordance with the recommendations of the manufacturer.
- G. Dowels: Wire dowels in position prior to placing concrete.
- H. Field Bending: Do not use heat to bend bars. Do not bend bars after being embedded in concrete.
- I. Welding: Welding of reinforcing will not be permitted.
- J. Place reinforcement a minimum of 2-inches clear of any metal pipe or fitting.
- K. Unless otherwise shown, install reinforcement with the following clearances for concrete coverage.
 - 1. Beams and Girders 2" outside of stirrups or ties

- | | |
|---|--|
| 2. Solid Slabs and Joists | 1" cover when there is no exposure to moisture
2" cover when placed against working slab at grade
3" cover when placed against earth |
| 3 .Columns | 2" outside of ties |
| 4. Walls | 1-1/2" on interior face, 2" on exterior face, 2" at water |
| 5. Grade Beams and Footings | 3" outside of steel, side and bottom, 2" top |
| 6. Formed Structures in
contact with soil or
exposed to weather,
water, sludge or sewage | 2" outside of steel |

END OF SECTION

SECTION 03250

CONCRETE ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide accessories for cast-in-place concrete.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork
- B. Section 03200, Concrete Reinforcement
- C. Section 03300, Cast-in-Place Concrete

1.03 SUBMITTALS

- A. Submit product data and samples in accordance with Sections 01300 and 01340.
- B. Submit product data on the following items:
 - 1. Water Stops
 - 2. Tongue and Groove Joint Forms
 - 3. Preformed Expansion Joint Fillers
- C. Submit samples on the following items:
 - 1. Water Stops
 - 2. Precast Concrete Block Supports for Reinforcing Bars

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Precast Concrete Block Supports For Reinforcing Bars: Comply with ACI 315. Provide blocks with No. 4 dowels bent 90 to support top bars.
- B. Membrane: 6 mil polyethylene film.
- C. Water Stops: Polyvinyl chloride meeting all requirements of U.S. Army Corps of Engineer's Specification CRD-C-572 and equal to Burke Water Stops as manufactured by The Burke Company. Provide flat dumbbell type and center bulb type, 9 inches x 3/8-inch at wall thickness of 12-inches or greater, and 6-inches x 3/8-inch at wall thickness less than 12-inches. Provide 6-inch split-ribbed with center bulb type at connections of new concrete structures with existing concrete. Provide water stops as indicated on the Drawings.
- D. Preformed Expansion Joint Filler:
 - 1. Bituminous type conforming to the requirements of ASTM D 994.
 - 2. Nonextruding type, self-expanding cork, 3/4-inch thick or as otherwise shown on the Drawings, conforming to the requirements of ASTM D1752, Type III, and compatible with the specified joint sealant compound.
- E. Joint Sealant: A multipart, gray, polyurethane sealant meeting U.S. Federal Specification TT-S-00227E (3) Type I, Class A self-leveling for horizontal joints, and Type II, Class A, non-sag for vertical joints, and recommended by the manufacturer for continuous immersion in water. Provide sealants as manufactured by Products Research and Chemical Corporation, Mameco International, The Burke Company, W.R. Meadows, or equal.
- F. Tongue And Groove Joint Forms: 24 gauge steel forms complete with steel stakes and splice plates, designed for joints not to receive a poured seal, and equal to Burke Keyed Kold Joint as manufactured by The Burke Company.
- G. Inserts: Galvanized steel to fit the proposed hanger or support.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Precast Concrete Block Supports For Reinforcing Bars: Provide in sufficient quantity to support reinforcing bars in slabs formed on earth at a spacing not to exceed 4-feet on centers in both directions. Provide blocks with dowels to support top bars. Block supports are not required in slabs formed on tremie concrete, but may be used at the Contractor's option. Blocks are not required for reinforcing bars properly supported from formwork. At other locations, refer to ACI 315 and CRSI MSP-1.
- B. Membrane: Provide polyethylene film under all slabs formed on earth, except for liquid containment structures. Lap membrane sheets 6-inches in the direction of spreading concrete. Do not puncture film.
- C. Water Stops:
 - 1. Installation: Protect water stops from dirt, oil and concrete spatter and rigidly secure in position by means of split bulkheads and by fastening to reinforcing bars in two directions at not more than 12 inches on centers. Install water stops in construction joints in hydraulic structures required to contain liquid or to resist the entry of groundwater.
 - 2. Splices: Butt-splice water stops using a thermostatically controlled electric splicing iron as recommended by the manufacturer.
- D. Expansion Joints: Provide expansion joints of size and at locations as shown on the Drawings. Place expansion joint fillers every 30 feet in straight runs of walkways, at right angle turns and wherever concrete butts into vertical surfaces, unless otherwise shown on the Drawings.
- E. Joint Sealants: Provide joint sealants where indicated on the Drawings. Prepare surfaces, prime, prepare materials, all in complete compliance with the manufacturer's instructions.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide cast-in-place concrete as shown on the Drawings and specified herein.

1.02 RELATED WORK

- A. Section 03100, Concrete Form Work
- B. Section 03200, Concrete Reinforcement
- C. Section 03250, Concrete Accessories
- D. Section 03600, Grout

1.03 QUALITY ASSURANCE

- A. Standards:
 - 1. Standard Building Code
 - 2. ACI 301, Specifications for Structural Concrete for Buildings
 - 3. ACI 318, Building Code Requirements for Reinforced Concrete
 - 4. Local codes and regulations
- B. Plant Qualification: Comply with all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C 94.
- C. Worker Qualification: Workers with at least 5 years experience in performing concrete work of high quality, including forming, color, texture and finishing and of the size and complexity of this project.
- D. Testing:

1. Provide testing in accordance with Section 01410. Keep the laboratory informed of testing schedule.
 2. Obtain standard laboratory compressive test cylinders as required by the laboratory when concrete is discharged from the mixer at the point of placing. Test cylinders will be made and cured by the laboratory in accordance with the requirements of ASTM C 31, including a set of 6 cylinders for each 50 cubic yards or fraction thereof placed each day, for each type of concrete. The cylinders will be cured under laboratory conditions and will be tested in two groups of three at 7 and 28 days of age, respectively in accordance with the requirements of ASTM C 39.
 3. Air entrainment tests will be made by the laboratory when concrete is discharged from the mixer at the point of placing, for each pour or other volume of concrete for which a set of test cylinders is required in accordance with the previous paragraph. The amount of air entrained will be determined by either the pressure method or the volumetric method in accordance with ASTM C231 or ASTM C173, respectively.
 4. The laboratory will make slump tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests will be made of every batch of concrete placed, and failure to meet specified slump requirements will be sufficient cause for rejection of that batch.
- E. Evaluation And Acceptance Of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 5.

1.04 SUBMITTALS

- A. Submit the following information in accordance with Sections 01300 and 01340.
1. Plant Qualification: Submit satisfactory evidence indicating compliance with the specified qualification requirements.
 2. Materials: Submit satisfactory evidence indicating that materials to be used, including cement, aggregates and admixtures meet the specified requirements.
 3. Design Mix: Submit the design mix to be used as prepared by qualified persons, including data on consecutive tests and standard deviation. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications.
 4. Submit, at least 24 hours before placing concrete, signed certification providing the following:
 - a. Exact location and portion of structure to be placed.

- b. Date and time concrete is to be placed.
- c. Type of concrete to be used (mix), and the method to be used in placing the concrete.
- d. Estimated quantity of concrete to be placed.
- e. That line and grade have been checked and grade properly compacted.
- f. That location, type, size and spacing of reinforcement has been checked and conform to the Drawings.
- g. That any water stops, construction joints, or seals have been placed and conform to the Drawings.
- h. That any embedded pipes have been placed, are the correct size and type and conform to the Drawings.
- i. That any embedded conduits, grounding wires or receptacles have been placed and conform to the Drawings.
- j. That any embedded anchor bolts, bearing plates, dowels etc. are in place, are of the correct size and are located as indicated on the Drawings.
- k. That forms are properly located and adequately braced.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement:

- 1. Domestic Portland cement conforming to the requirements of ASTM C 150 Type I, Type II or Type III. Construct structures exposed to sewage with Type II cement. Use Type III cement for high early strength concrete only for special locations and only with the approval of the Engineer. Use Type I cement for tremie concrete.
- 2. Use only one brand of cement in any individual structure unless otherwise approved by the Engineer. Do not use cement which has become damaged, partially set, lumpy or caked and discard the entire contents of the sack or container which contains such cement. Do not use salvaged or reclaimed cement.

3. Fly Ash: Fly ash meeting the requirements of ASTM C618, Class F, may be used as a cement replacement in portland concrete on a pound per pound basis. Sampling and testing of the fly ash shall follow the requirements of ASTM C311.
 - a. Prior to its use, submit the supplier's certified test reports from an approved laboratory certifying that the fly ash conforms to this Specification and was obtained from the residue of an electric generating plant using only ground or powdered coal.
 - b. The quantity of cement replaced by fly ash shall be between 18% and 22% for all concrete uses.

B. Aggregates:

1. ASTM C 33. Coarse aggregates shall be size No. 67, 3/4-inch to No. 4 or No. 57, 1-inch to No. 4, as shown on the Drawings, unless otherwise directed by the Engineer. Use size No. 8 for filling of cells of masonry units.
2. In addition to requirements of ASTM C 33, apply the following criteria for structures exposed to sewage:
 - a. Soft particles: Not more than 2.0 percent
 - b. Chert as a soft impurity (defined in Table 3 of ASTM C 33): Not more than 1.0 percent
 - c. Total of soft particles and chert as a soft impurity: Not more than 2.0 percent
 - d. Flat and elongated particles (long dimension more than 5 times short dimension): Not more than 15.0 percent

C. Water: Potable quality, clean and free from injurious amounts of deleterious materials.

D. Air Entraining Admixture: ASTM C 260.

E. Water Reducing and Retarding Admixture:

1. Concrete Without Superplasticizer:
 - a. Water Reducing Admixtures: ASTM C494 Type A, equal to Eucon WR-75 by the Euclid Company, Pozzolith 200N by Master Builders, or Plastocrete 161 by Sika Chemical Corporation, and containing no calcium chloride.

- b. Water Reducing and Retarding Admixtures: ASTM C494 Type D, equal to Eucon Retarder-75 by the Euclid Company, Pozzolith 100 XR by Master Builders, or Plastiment by Sika Chemical Corporation, and containing no calcium chloride.
 - c. Accelerating Admixtures: ASTM C494 Type C or E, equal to Accelguard 80 by the Euclid Company or Darex Set Accelerator by W.R. Grace, and containing no calcium chloride.
- 2. Concrete With Superplasticizer:
 - a. Water Reducing, High Range Admixtures: ASTM C494, Type F or G, equal to Eucon 37 by the Euclid Company, Rheobild 716 by Master Builders, Daracem 100 by W.R. Grace or Sikament by Sika Chemical Corporation, and consisting of a second-generation admixture, free of chlorides and alkalis (except for those attributable to water) composed of a synthesized sulfonated complex polymer, enabling the concrete to maintain its rheoplastic state in excess of two hours if necessary.
 - b. Manufacturer's Job Site Representation: Provide the services of a competent field service representative from the manufacturer of each of the admixtures selected for use to provide at the job site advice and consultation on the use of the admixture materials, including the effect on the concrete in place, including recommending maximum discharge time for superplasticizer method and procedure to induce superplasticizer into mixer, quantities of admixtures to be used if variations are required because of temperature/humidity, wind, or other environmental considerations, and to be available on short call at any time requested by the Owner, Contractor, or concrete producer.
- F. Curing Compound: ASTM C 309, Type 1 and Type 1D, Class A and Class B, containing no ingredient which would adversely affect the bond of coatings or toppings.
 - 1. For exposed concrete not to receive special finishes, protective coatings and/or concrete toppings, provide curing and sealing compound equal to Super Rez- Seal, by Euclid Chemical Co., or Burke Spartan-Cote Cure-Seal Hardener by The Burke Company.
 - 2. For exposed concrete to receive special finishes, protective coatings and/or concrete toppings, provide curing compound equal to Kurez-DR, by Euclid Chemical Co., or Burke Rez-X Curing Compound by The Burke Company.

- G. Mortar for Repair of Concrete: Same materials as used for concrete, except omit coarse aggregate and use not more than one part cement to two and one-half parts sand by damp loose volume. Use no more mixing water than is necessary for handling and placing.
- H. Burlap Mats: Conform to AASHTO Specification M182.
- I. Epoxy Bonding Agent: Euco #452, BurkEpoxy MV, Sikadur Hi Mod, Concresive 1001-LPL, or equal.
- J. Powdered Epoxy Coating For Anchor Bolts: Powdered epoxy resin as manufactured by the 3M Company, Scotchkote No. 213, Armstrong No. R349, or equal.

2.02 MIXES

A. General Requirements:

1. Mix Design: Conform to ACI 318, Section 5.3. Submit data on consecutive tests and standard deviation.
2. Maximum Water-Cement Ratio:
 - .37 (lbs/lb) - Concrete with superplasticizer
 - .45 (lbs/lb) - Class A concrete without superplasticizer
 - .55 (lbs/lb) - Class B concrete without superplasticizer
 - .65 (lbs/lb) - Class C concrete without superplasticizer
3. Air Content: 5 percent plus or minus 1.5 percent (Class A and B).
4. Slump: 4-inches plus or minus 1-inch for Class A and B without superplasticizer.
 7-inches plus or minus 1-inch for Class A and B with
 super-plasticizer.
 8-inches plus or minus 1-inch for tremie concrete.
5. Minimum Compressive Strength at 28 Days:
 - Tremie, 4000 psi
 - Class A, 4000 psi, structural and precast
 - Class B, 3000 psi, slabs on grade, pipe supports, concrete fill, curbs and
sidewalks
 - Class C, 2500 psi thrust blocks and pipe encasement

B. Production Of Concrete:

1. General: Use ready mixed concrete, batched, mixed and transported in accordance with ASTM C 94, unless otherwise indicated.

2. Air Entraining Admixture: Add admixture into the mixture as a solution measured by means of an approved mechanical dispensing device, and as a part of the total mixing water. If fly ash is used in this mix, ensure that the specific air content is maintained, by the use of additional air-entrainment mixture if necessary.
 3. Water Reducing and Retarding Admixture: Measure and add water reducing and retarding admixture as recommended by the manufacturer. Complete the addition of the admixture within one minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Store, handle and batch admixtures in accordance with the recommendations of ACI 68.
- C. Delivery Tickets: Conform to ASTM C94, including cement content and water/cement ratio. Furnish ticket for each batch of ready-mixed concrete delivered to the site.
- D. Temperatures: Deliver concrete to site at temperature not higher than 90°F, otherwise, add ice to reduce the temperature, as recommended by ACI.
- E. Modifications To The Mix: Do not make modifications to the mix in the plant or on the job which will decrease the cement content or increase the water-cement ratio beyond that specified.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Preparations Before Placing: Place no concrete until the approval of the Engineer has been received. Ensure that forms are thoroughly clean and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. Notify Engineer 24 hours before concrete is placed.
- B. Conveying:
1. General: Transport concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. Place no concrete more than 90 minutes after mixing has begun for that batch.
 2. Buckets and Hoppers: Provide buckets and hoppers having discharge gates with a clear opening equal to no less than one-third of the maximum interior horizontal area or five times the maximum aggregate size being used, and having side slopes no less

than 60 degrees. Provide controls on gates to permit opening and closing during the discharge cycle.

3. Runways: Provide runways as specified in Section 03100. Use extreme care to avoid displacement of reinforcement during the placing of concrete.
4. Elephant Trunks: Use hoppers and elephant trunks to prevent the free fall of concrete for more than 6-feet.
5. Chutes: Provide metal or metal lined chutes having a slope not exceeding one vertical to two horizontal and not less than one vertical to three horizontal. Use chutes more than 20-feet long and chutes not meeting the slope requirements only if they discharge into a hopper before distribution.
6. Pumping Equipment: If required, provide pumping equipment and procedures conforming to ACI 304.2R, Placing Concrete by Pumping Methods. Measure slump at the point of discharge. Do not allow loss of slump in pumping to exceed 1 1/2-inches.
7. Conveying Equipment Construction: Do not use aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer.
8. Cleaning: Clean conveying equipment at the end of each concrete operation.

3.02 APPLICATION

A. Placing:

1. General: Deposit concrete continuously, or in layers of such thickness (not exceeding 2-feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. Repair any such seams or planes of weakness with injected epoxy grout and patch to match adjacent surfaces.
2. Supported Elements: Allow at least two hours to elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.
3. Segregation: Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not subject the concrete to procedures which cause segregation.
4. Concrete Under Water: Place all concrete in the dry except for Tremie concrete.

5. Concrete Fill at Tank Bottom Slab: Where shown on the Drawings, place concrete fill for the tank bottoms within the tolerances described herein and in accordance with the equipment manufacturer's recommendations for the clearance required by the mechanical equipment. Do not operate the mechanical equipment of the tanks as a primary screed for moving the concrete fill, except in the final screeding operation, provided any damage to the equipment is repaired at no additional cost to the Owner.

B. Seals And Tremie Concrete:

1. General:
 - a. Wherever practicable, dewater all foundation excavations and deposit the concrete in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, place a concrete foundation seal as shown on the Drawings. Then dewater the foundation and place the balance of the concrete in the dry.
 - b. Place seal concrete in a manner to ensure satisfactory performance of the seal in providing a watertight excavation for subsequent placing of structural concrete. Repair or replace any seal concrete which subsequently fails to perform properly, as necessary to perform its required function, at no cost to the Owner.
2. Method of Placing: Deposit concrete under water by means of a tremie, a closed-bottom dump bucket of not less than one cubic yard capacity, or other approved method, in one continuous pour. Do not place concrete in running water. Provide watertight form work and excavation sheeting designed by a Professional Engineer, registered in the State of Florida, for all form work required to retain concrete under water.
3. Use of Tremie: For depositing concrete under water, use a tremie consisting of a tube having a minimum inside diameter of ten inches, and constructed in sections having tight joints. Do not use aluminum parts in contact with the concrete. Ensure that the discharge end is entirely seated at all times and that the tremie tube is kept full to the bottom of the hopper. When a batch is dumped into the hopper, slightly raise the tremie (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper; then stop the flow by lowering the tremie. Support the tremie in such a manner as to permit the free movement of the discharge end over the entire top surface of the work, and to permit it being lowered rapidly when necessary to choke off or retard the flow. Do not interrupt concrete flow until the work is completed. Use special care to maintain still water at the point of deposit.
4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, lower the bucket gradually and carefully until it rests upon the

concrete already placed. Then raise the bucket very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.

5. Time of Beginning Pumping: Do not start pumping to dewater a sealed cofferdam until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72 hours after placement of the concrete.

C. Consolidating Concrete:

1. General: Consolidate concrete by means of internal vibrators operated by competent workmen.
 2. Vibrators: Use vibrators having a minimum head diameter of at least 2-inches, a minimum centrifugal force of 700-pounds and a minimum frequency of 8,000 vibrations per second.
 3. Vibrators for Confined Areas: In confined areas, use additional vibrators having a minimum head diameter of 1 1/2-inches, a minimum centrifugal force of 300-pounds and a minimum frequency of 9,000 vibrations per second.
 4. Spare Vibrator: Keep one spare vibrator for each three in use on the site during all concrete placing operations.
 5. Use of Vibrators: Insert and withdraw vibrators at points approximately 18-inches apart. At each insertion operate vibrator for 5 to 15 seconds. Do not transport concrete in the forms by means of vibrators.
- D. Protection: Do not allow rainwater to increase the mixing water or to damage the surface finish. Protect concrete from construction overloads and do not apply design loads until the specified strength has been attained.
- E. Construction Joints: Except as otherwise indicated on the Drawings, provide horizontal construction joints at top of foundation members and slabs on grade and at the soffit of supported slabs and beams. Locate other horizontal and vertical construction joints as indicated on the Drawings. Except in the locations shown, provide no other joints, unless otherwise recommended by the Contractor and approved by the Engineer.
- F. Bonding: Before depositing new concrete on or against concrete that has set, thoroughly clean the surfaces of the set concrete to expose the coarse aggregate and to ensure they are free of laitance, coatings, foreign matter and loose particles. Retighten forms. Dampen, but do not saturate hardened concrete of joints and then thoroughly cover with a coat of cement grout of similar proportions to the mortar in the concrete. Place the grout as thick as

possible on vertical surfaces and at least 1/2-inch thick on horizontal surfaces. Place the fresh concrete before the grout has attained its initial set.

- G. **Embedded Items:** In addition to steel reinforcement, securely place pipes, inserts and other metal objects as shown, specified or ordered to be built into, set in or attached to the concrete. Take all necessary precautions to prevent these objects from being displaced, broken or deformed. Before concrete is placed, take care to determine that all embedded parts are firmly and securely fastened in place as indicated. Thoroughly clean surfaces free from paint and other coating, rust, scale, oil, and any foreign matter. Pressure test embedded pipes for leakage, as specified elsewhere, before concrete is placed. Wrap metal rainwater leaders, firelines and other such piping with at least two thicknesses of 30 lb. roofing felt before placing concrete. Do not embed wood in concrete. Pack concrete tightly around pipes and other metal work to prevent leakage and to secure perfect adhesion. Adequately protect drains from intrusion of concrete.
- H. **Bonding To Existing Surfaces:** Clean existing concrete surfaces that are to have new concrete bonded thereto of all grease, oil, dust, dirt and loose particles and coat with an epoxy bonding agent just prior to placing of the new concrete. Apply the bonding agent as recommended by the manufacturer and allow the agent to become tacky before the new concrete is placed. Do not allow the bonding agent to overlap or be spilled on the surfaces to be exposed after the work is completed.

3.03 FORM REMOVAL

- A. Maintain formwork in place for the following structural conditions until the concrete has attained the minimum percentage of indicated design compressive strength or for the period of time specified in the following table.

Note: Time periods in the table include all days except those in which the temperature falls below 40 degrees F.

<u>Structural Member or Condition</u>	<u>Normal Strength Concrete</u>	<u>Normal High-Early Strength Concrete</u>	<u>Minimum Compressive Strength for Form Removal (% Design Strength)</u>
Cantilevers	12 days	7 days	90
Over 20 feet between supports	12 days	7 days	90
Stairways	10 days	5 days	80

Floor slabs	5 days	3 days	70
Free standing walls, column and piers	5 days	3 days	70
Walls, piers, columns, sides of beams, footings, slabs on grade, and vertical surfaces	24-48 hours	12-24 hours	70
Front face form of curbs	6-24 hours	6 hours	70

3.04 CONCRETE FINISHINGS

A. Repair Of Surface Defects:

1. General: Repair surface defects, including tie holes immediately after form removal. Dampen the area to be patched and an area at least 6-inches wide surrounding it to prevent absorption of water from the patching mortar. Notify the Engineer prior to commencing operations.
2. Removal of Defective Concrete: Remove all honeycombed and other defective concrete down to sound concrete. Cut edges perpendicular to the surface or slightly under cut. Sand blast surfaces to receive repair.
3. Bonding Grout: Thoroughly dampen surfaces to be patched and apply a coat of bonding grout consisting of one part cement to one part fine sand passing a No. 30 sieve and having the consistency of thick cream.
4. Placing Patching Mortar: After the bonding grout begins to lose its water sheen, apply a premixed patching mortar, thoroughly consolidating it into place and striking it off so as to leave the patch slightly higher than the surrounding surface. Leave mortar undisturbed for one hour to permit initial shrinkage and then finally finish.
5. Tie Holes: After being cleaned and thoroughly dampened, fill the tie holes solid with patching mortar.

B. Concrete Finishes:

1. Formed Surfaces: After removal of forms, chip off all irregular projections, grind flush with adjacent surfaces and finish concrete surfaces in accordance with the following schedule:

Finish
Designation Area Applied

F-1 Exterior walls below grade not exposed to water:
Repair defective concrete, fill depressions deeper than 1/2-inch, and fill tie holes.

F-2 Exterior and interior walls exposed to water:
Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes.

F-3 Walls of structures of buildings exposed to view and underside of formed floors or slabs:
In addition to Finish F-2, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry consisting of one part cement and one and one-half parts sand by damp loose volume on the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.

F-4 Tops of walls, beams and similar unformed surfaces occurring adjacent to formed surfaces:
Strike smooth after concrete is placed and float to a texture reasonably consistent with that of formed surfaces.

2. Slab Surfaces:

- a. General: After concrete has been consolidated, finish all concrete slabs with a floated finish. After floating, trowel finish all concrete slabs, except for areas to receive roofing, insulation, tile or topping, and immediately light broom finish. Where a finish is not indicated, provide a troweled finish.

Finish
Designation Area Applied

S-1 Slabs and floors not water bearing:
Smooth steel trowel finish.

S-2 Slabs and floors which are water bearing and slab surfaces on which mechanical equipment moves:
Steel trowel finish free from trowel marks and all irregularities.

S-3 Slabs, floors and stair treads of structures or buildings exposed to view:

Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

S-4 Slabs and floors at slopes greater than 10%:

Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines parallel to the direction of slope drainage.

S-5 Exposed edges of slabs, floors and tops of walls:

Finish with a 1/4-inch radius edge if a chamfer is not indicated.

- b. Floated Finish: After concrete has been placed, consolidated, struck off and leveled, do not work the surface further until water sheen has disappeared and the surface has hardened sufficiently to permit floating. During the first floating, check the planeness of the slab with a 10-foot straightedge applied at no less than two angles. Cut down all high spots and fill all low spots to produce a surface having the required tolerance. Then refloat the slab to a uniform sandy texture.
- c. Light Broomed Finish: After floating, power trowel slabs to receive a light broomed finish to produce a smooth surface, relatively free of defects. Before the surface sets, pass a soft broom drag over the surface to produce a surface uniform in texture and appearance.
- d. Troweled Finish: After floating, power trowel slabs to receive a troweled finish to produce a smooth surface, relatively free of defects. Hand trowel after the surface has hardened sufficiently. When a ringing sound is produced as the trowel is moved over the surfaces, perform final troweling by hand to produce a surface which is thoroughly consolidated, free from trowel marks, uniform in texture and appearance and plane to a tolerance of 1/8 inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.
- e. Hardener Finish: Where indicated to receive a troweled hardener finish, water cure slabs without application of curing and sealing agent. When slab is at least 28 days old and thoroughly dry, apply the hardener in accordance with the manufacturer's recommendations. Where dry-shake hardener or slip-resistant finish is required, apply the hardener or slip-resistant product prior to complete curing and finishing, in accordance with the requirements and recommendation of the product manufacturer.

- f. Saw Cut Joints: Cut joints that are to be saw cut not sooner than 2 hours after the concrete is poured and not later than 8 hours after the pour.

3.05 PROTECTING

A. Curing:

1. Immediately after surface defects have been repaired, apply a spray coat of curing compound to all exposed surfaces, including slabs, walls, beams and columns in accordance with the manufacturer's recommendations. Protect exposed steel keyways and other embedded items from the curing compound. Water cure, as specified in paragraph B hereunder, all concrete surfaces that are to be exposed to wastewater, surfaces that are to be coated with a coal tar epoxy system, and concrete floors requiring a bond for special finishes.
2. Do not apply curing compound during periods of rainfall. Should the film become damaged from any cause within the required curing period, immediately repair the damaged portions with additional compound. Upon removal of forms, immediately coat the newly exposed surfaces to provide a curing treatment equal to that provided for the surface.
3. Curing and Sealing Compound: Use clear compound conforming to Federal Specification TT-C-800A, 30% solids content minimum, having test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon, and equal to Super Floor Coat or Super Pliocure by The Euclid Chemical Company or Masterseal 66 by Master Builders. Furnish manufacturer's certification as required.
4. Apply specified clear curing and sealing compound to all horizontal areas so noted on the Drawings or in the Specifications. Apply immediately after final finishing. Apply this compound to non-structural construction joints of slabs on grade to act as a bond breaker prior to placement of adjacent concrete.

B. Water Curing Method: Cure all concrete that is to be water cured by either the wet burlap method, by continuous fogging or by covering with waterproof sheet.

1. Wet Burlap Method: Cover concrete surface with a double thickness of burlap, cotton mats, or other approved material, kept thoroughly saturated with water. Keep the forms wet until removed and upon removal, start the curing specified herein immediately. Cure the concrete for a period of 7 days for normal Portland cement or 4 days for high early strength cement. Do not submerge concrete poured in the dry until it has attained sufficient strength to adequately sustain the stress involved and do not subject it to flowing water across its surface until it has cured 4 days.
2. Continuous Fogging: Perform continuous fogging by fogging with a nozzle which so atomizes the flow of water that a mist, and not a spray, is formed. Fog the concrete

surface regularly without allowing any part of the surface to become dry. Take all necessary precautions to prevent erosion of the concrete surface by the water.

3. Covering With Waterproof Sheet: Keep the entire area to be cured continuously wet by fogging, as specified in the fogging paragraph above, for at least 18 hours and then immediately cover with waterproofing curing sheet conforming to ASTM C171, waterproof paper and polyethylene film, free of holes or tears. Keep sheet fully flat, without wrinkles or air bubbles, held down tautly at all edges. Do not use this method on slabs which will be exposed to view.

END OF SECTION

SECTION 03600

GROUT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide all labor, materials, tools and equipment and perform all grouting as specified hereinafter and indicated on the Drawings.

1.02 RELATED WORK

- A. Section 03300, Cast-In-Place Concrete

1.03 SUBMITTALS

- A. Submit manufacturer's literature for review on the following items:
 - 1. Nonshrink grout data including grout properties, mixing, surface preparation and installation instructions.
 - 2. Mix design for clarifier basin grout.

1.04 DELIVERY AND STORAGE

- A. Deliver and store grouting materials in unbroken containers with seals and labels intact as packaged by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Nonshrink, Nonmetallic Grout: The Burke Company's Non-Ferrous, Non-Shrink Grout, Sauereisen F-100 Level Fill, Master Builders Masterflow 713, Euclid NS Grout, or equal pre-mixed type.
- B. Nonshrink Metallic Grout: The Burke Company's Metallic Spec Grout, Master Builders Embeco 636 Grout pre-mixed type, or equal.
- C. Epoxy Grout: Sikadur 42 Grout-Pak, or equal, for grouting sleeves for anchor bolts, etc.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean all bonding surfaces of dust and oil.

3.02 INSTALLATION

- A. Nonshrink Grout:

1. Use nonshrink, nonmetallic grout for grouting precast concrete wall panel connections, column base plates, anchor bolts, reinforcing bars, pipe sleeves, machinery supports and pump base plates. Use epoxy grout for anchor bolts, etc., where indicated on the Drawings.
2. Mix and place nonshrink grout as recommended by the manufacturer.
3. Mix grout as close to the work area as possible and transport quickly to its final position in a manner which will not permit segregation of materials.
4. Cure nonshrink grout with water saturated burlap for at least three days or with an application of Super Rez Seal cure and seal compound applied immediately after grout placement.
5. Do not operate machinery set on grout pads until the grout has cured for at least 24 hours.

END OF SECTION

SECTION 05500

MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall provide miscellaneous metalwork and appurtenances, complete and in place, in accordance with the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications

MIL-G-18015 A (3) (Ships) Aluminum Planks. (6063-T6)

MIL-A-907E Antiseize Thread Compound, High Temperature

B. Commercial Standards

AA-M32C22A41 Aluminum Assn.

AASHTO HS-20 Truck Loading

AISC Manual of Steel Construction

AISI Design of Light Gauge, Cold-Formed Steel Structural Members

ASTM A 36 Carbon Structural Steel

ASTM A 48 Gray Iron Castings

ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 193 Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service

ASTM A 194 Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service

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ASTM A 307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 992	Steel for Structural Shapes for Use in Building Framing
ANSI/AWS D1.1	Structural Welding Code - Steel
ANSI/AWS D1.2	Structural Welding Code - Aluminum
ANSI/AWS QC1	Qualification and Certification of Welding Inspectors

1.03 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01300 - Submittals.
- B. **Shop Drawings:** Shop Drawings shall conform to AISC recommendations and specifications and shall show holes, etc. required for other parts of the WORK. Drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.
 - 1. Layout drawings for grating, showing the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners. Load and deflection tables shall be submitted for each style and depth of grating used.
 - 2. An ICBO report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor. CONTRACTOR shall submit manufacturer's recommended installation instructions and procedures for adhesive anchors. Upon review by ENGINEER, these instructions shall be followed specifically.
 - 3. No substitution for the indicated adhesive anchors will be considered unless accompanied with ICBO report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75 degrees F.

1.04 QUALITY ASSURANCE

- A. Weld procedures and welder qualifications shall be available in the CONTRACTOR's field office for review.
- B. Welding shall be inspected by a CONTRACTOR-furnished inspector qualified in accordance with AWS requirements and approved by the ENGINEER.

MISCELLANEOUS METALWORK

PART 2 -- PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Steel

Wide Flange Shapes	ASTM A 992
Shapes, Plates, Bars	ASTM A 36
Pipe, Pipe Columns, Bollards	ASTM A 53, Type E or S, Grade B standard weight unless indicated otherwise
HSS	ASTM A 500 Grade B

- B. **Corrosion Protection:** Unless otherwise indicated, fabricated steel metalwork which will be used in a corrosive environment and/or will be submerged in water/wastewater shall be coated in accordance with Section 09905 – Painting and Protective Coatings and shall not be galvanized prior to coating. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication.
- C. **Stainless Steel:** Unless otherwise indicated, stainless steel metalwork and bolts shall be of Type 316 stainless steel.
- D. **Aluminum:** Unless otherwise indicated, aluminum metalwork shall be of Alloy 6061-T6. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with Section 09905.
- E. **Cast Iron:** Unless otherwise indicated, iron castings shall conform to the requirements of ASTM A 48, Class 50B or better.

2.02 HATCHES

- A. Where access hatches are mounted on a floor slab (including top slabs that are not covered with a roofing membrane) or on a concrete curb, the hatch shall be a flush type as indicated.
- B. Hatches mounted on a roof surface that has a membrane or other roofing material covering it shall be the integral raised curb type.
- C. Hatches shall be fabricated from aluminum 5086 H34, 6063-T5 or 6061-T6, unless otherwise indicated. Hatch hardware shall be Type 316 stainless steel. Hatches shall be gutter-type; **Bilco Type J or JD, Babcock-Davis Type B-FGA** or equal.
- D. The design live load shall be 300 psf, unless indicated otherwise.

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- E. Hatch opening sizes, number and swing direction of door leaves, and locations, shall be as indicated. Sizes are for the clear opening. Where the number of leaves is not given, openings larger than 42-inches in either direction shall have double-leaf doors. Unless indicated otherwise, hinges shall be located on the longer dimension side. Unless indicated otherwise, ladder hatches shall be a minimum of 30-inches wide by 36-inches long, with the ladder centered on the shorter dimension, and the door hinge opposite the ladder.
- F. Door leaves shall be a minimum of 1/4-inch thick checkered pattern plate. Channel frames shall be a minimum of 1/4-inch material with an anchor flange around the perimeter. Hatches shall be provided with an automatic hold-open arm with release handle. Hatches shall be designed for easy opening from both inside and outside.
- G. Hatches shall be designed to be water-tight and shall be equipped with a joint gutter and moat-type edge drain. A minimum 1-1/2 inch diameter drain connection shall be provided, located by the manufacturer.
- H. Hatches for submersible pump stations shall include a unistrut channel around the frame perimeter. The face of the unistrut channel shall be flush with the face of the frame and be compatible with the upper guide rail bracket of the submersible wastewater pump manufacturer.
- I. Hatches shall include a recessed hasp for a padlock that is covered by a hinged lid flush with the surface.
- J. Unless indicated otherwise, hatch nets shall be installed on floor hatches. Hatch nets shall conform to OSHA requirements and shall be **Hatch Net 121**, as manufactured by **Safe Approach, Inc.**, Auburn, ME, or equal

2.03 IRON CASTINGS

- A. Iron castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. They shall be smooth and well cleaned by shotblasting.
- B. Covers and grates shall fit together evenly, so that the cover fits flush with the surrounding finished surface and so that the cover does not rock or rattle when loading is applied. Round covers and frames shall have machined bearing surfaces.
- C. Covers and grates with matching frames shall be designed to support the following loadings:
 - 1. Where located within a structure, the design loading shall match that required for the adjacent floor area, or, if no floor loading is given, a minimum of 300 pounds per square foot.

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2. Exterior covers and grates shall be designed for AASHTO HS-20 loading unless indicated otherwise.

2.04 MANHOLE RUNGS

- A. Rungs shall meet ASTM C 478 - Precast Reinforced Concrete Manhole Sections and the following:
 3. Rungs shall be spaced not less than 10-inches apart nor more than 14-inches apart as measured between centerlines of the rungs.
 4. Rungs shall be parallel, level, and uniformly spaced.
 5. The rungs shall be shaped such that feet cannot slide off the end of the rungs.
 6. Rungs shall be surfaced so as to prevent injury from punctures or lacerations, and to prevent snagging of clothing.
 7. The minimum perpendicular clearance between rungs and any obstruction behind the ladder shall be 6-inches.
 8. The minimum width of rungs shall be 14-inches.
- B. CONTRACTOR shall submit certified test results in accordance with ASTM C 497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile, Section 10, for the following loads:
 9. Horizontal pull out load shall be 400 pounds
 10. Vertical load shall be 800 pounds .
- C. Rungs shall be made of co-polymer polypropylene that encapsulates a minimum 1/2-inch grade 60 steel reinforcing rod. The co-polymer polypropylene shall meet ASTM D 4101, Type PP200B33430.

2.05 BOLTS AND ANCHORS

- A. **Standard Service (Non-Corrosive Application):** Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel as indicated. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolt material, anchor bolts, and cap screws shall be in accordance with the following:
 1. Structural connections: ASTM A 307, Grade A or B, hot-dip galvanized.
 2. Anchor Bolts: ASTM A 307, Grade A or B, or ASTM A 36, hot-dip galvanized.
 3. High strength bolts where indicated: ASTM A 325.

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4. Pipe and equipment flange bolts: ASTM A 193, Grade B-7.
- B. **Corrosive Service:** Bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated.
5. Buried locations.
 6. Submerged locations.
 7. Locations subject to seasonal or occasional flooding.
 8. Inside hydraulic structures below the top of the structure.
 9. Inside buried vaults, manholes, and structures that do not drain through a gravity sewer or to a sump with a pump.
 10. Chemical handling areas.
 11. Inside trenches, containment walls, and curbed areas.
 12. Locations indicated by the Contract Documents or designated by the ENGINEER to be provided with stainless steel bolts.
- C. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel, Class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts. Buried pipe flange bolts and nuts on pipe of Class 275 and greater shall be ASTM A193/A194, Grade B7. Threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.
13. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.
 14. Antiseize lubricant shall be "PURE WHITE" by **Anti-Seize Technology**, Franklin Park, IL, 60131, AS-470 by **Dixon Ticonderoga Company**, Lakehurst, NJ, 08733, or equal.
- D. Bolt Requirements
1. The bolt and nut material shall be free-cutting steel.
 2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

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3. Bolts and nuts shall be installed with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers fabricated of material matching the bolts shall be installed where indicated.
 4. The length of each bolt shall be such that the bolt extends at least 1/8-inch beyond the outside face of the nut before tightening, except for anchor bolts, which shall be flush with the face of the nut before tightening.
- E. **Adhesive Anchors:** Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.
1. Epoxy adhesive anchors are required for drilled anchors for indoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars. Epoxy shall comply with Section 03600 - Grout. Threaded rod shall be galvanized for general purpose applications and stainless steel Type 316 for corrosive applications. Epoxy anchors shall not be permitted in areas where the concrete temperature is in excess of 100 degrees F or higher than the limiting temperature recommended by the manufacturer, whichever is lower. Epoxy anchors shall not be used where anchors are subject to vibration or fire. Embedment depth shall be as the manufacturer recommends for the load to be supported.
 2. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above and shall be **Hilti HVA** or **Cobra Anchors**. Threaded rod shall be galvanized steel.
- F. **Expanding-Type Anchors:** Expanding-type anchors if indicated or permitted, shall be galvanized steel expansion type **ITW Ramset/Redhead Trubolt** anchors, **McCulloch Industries Kwick-Bolt**, or equal. Lead caulking anchors will not be permitted. Size shall be as indicated. Embedment depth shall be as the manufacturer recommends for the load to be supported. Expansion type anchors that are to be embedded in grout may be steel. Non-embedded buried or submerged anchors shall be stainless steel.
- G. **Non-Shrink Grouted Anchors:** Anchors, if indicated or permitted, shall be grouted with a non-shrink cementitious grout in accordance with the manufacturer's recommendation. Embedment depth shall be as the manufacturer recommends for the load to be supported. Non-shrink grout material shall be Class B or C in accordance with Section 03600 - Grout.

2.06 POWDER-DRIVEN PINS

- A. **Materials:** Powder-driven pins for installation in concrete or steel shall be heat-treated steel alloy. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they will be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

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2.07 IMPACT ANCHOR

- A. Impact anchors shall be an expansion type anchor in which a nail type pin is driven to produce the expansive force. The pin shall have a zinc sleeve with a mushroom style head and stainless steel nail pin. Anchors shall be **Metal Hit Anchors**, manufactured by **Hilti, Inc.**, **Rawl Zamac Nailin**, manufactured by the **Rawlplug Company**, or equal.

PART 3 -- EXECUTION

3.01 FABRICATION AND INSTALLATION REQUIREMENTS

- A. **Fabrication and Erection:** Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."
- B. **Aluminum Railings:** Aluminum railing fabrication and installation shall be performed by craftsmen experienced in the fabrication of architectural metalwork. Exposed surfaces shall be free from defects or other surface blemishes. Dimensions and conditions shall be verified in the field. Joints, junctions, miters, and butting sections shall be precision fitted with no gaps occurring between sections, and with surfaces flush and aligned. Electrolysis protection of materials shall be provided.
- C. **Floor Hatches:** Unless otherwise indicated, the CONTRACTOR shall provide a 1/2-inch drain line to the nearest floor drain for floor hatches.
- D. **Powder-Driven Pins:** Powder-driven pins shall be installed by a craftsperson certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = pin's shank diameter:

Material Penetrated by Pin	Material Minimum Thickness	Pin Shank Penetration in Supporting Material	Minimum Space From Pin's CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	20D
Steel	1/4-inch	Steel thickness	4D	7D