



**ENGINEERING DESIGN STANDARDS FOR
WATER RESOURCE FACILITIES**

**TSALA APOPKA GOLF COURSE STRUCTURE
MODIFICATION (C680)**

TECHNICAL SPECIFICATIONS

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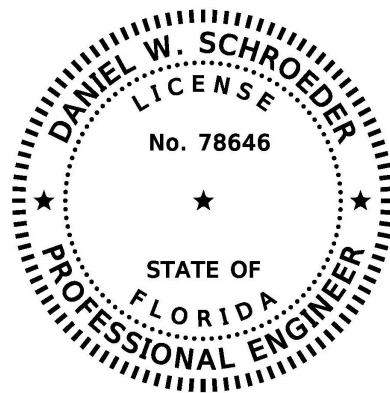
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END OF DIRECTORY

The CONTRACTOR shall carefully study and compare all Drawings, Specifications and other instructions; shall test all figures on the Drawings before laying out the Work; shall notify the ENGINEER of all errors, inconsistencies, or omissions which he may discover; and obtain specific instructions before proceeding with the Work. The CONTRACTOR shall not take advantage of any apparent error or omissions which may be found in the Drawings or Specifications, and the ENGINEER shall be entitled to make such corrections therein and interpretations thereof as may be deemed necessary for the fulfillment of their intent. The CONTRACTOR shall be responsible for all errors in construction which could have been avoided by such examination and notification and shall correct, at its own expense, all Work improperly constructed through failure to notify the ENGINEER and request specific instructions.

The Southwest Florida Water Management District Standard Specifications herein have been reviewed and modified by the design team and found appropriate for use for this project:



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY:

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

*AIM ENGINEERING & SURVEYING, INC.
2161 FOWLER ST., STE. 100
FORT MYERS, FL. 33901
CERTIFICATE OF AUTHORIZATION NO.: 3114
DANIEL W. SCHROEDER, P.E. NO. 78646*

Engineer Name, P.E.
Florida Registration No.

SECTION 01010 SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY: This SECTION summarizes the WORK of the Project as covered in detail in the complete Contract Documents. This is a general summary and is not intended to be complete and all inclusive of the required WORK items.

1.02 PROJECT DESCRIPTION:

- A. Description of Total Project: The structure is located within a 100-foot county road right-of-way and within the 100-foot canal right-of-way just off E. Sandpiper Drive on the east side of the Inverness Golf and Country Club, (just outside of the country club proper). Furthermore, the structure is situated about 4 miles southeast of the City of Inverness in Citrus County, in the Withlacoochee River Basin, in Section 26, Township 19 S, Range 20 E. Take Interstate 75 north to State Road 50, exit 301. Follow S.R. 50 left/west to U.S. Highway 41. Take 41 right/north to Eden Drive, about 1 mile south of downtown Inverness. Then right (at the traffic light) on Eden for a short distance to Old Floral City Road, the first crossroad. Follow Old Floral City Road right for 1.7 miles to E. Sandpiper Drive: the entrance to the Inverness Golf and Country Club. Follow Sandpiper for 1.1 miles to the structure.
- B. The project consists of modifying an existing operable control structure by removing the existing four 4'x4' gates and replacing with two 8'x8' gates with prestressed concrete piles, gate support structure, metallization of existing structure, channel stabilization via rip-rap and concrete slope pavement, electrical modifications, restoration sodding, survey layout and as-built, earthwork, dewatering, retaining wall construction, catwalk with handrail, surveyed staff gauges and other incidental activities.

1.03 RELATED CONTRACT ACTIVITIES:

- A. The CONTRACTOR shall provide adequate bank protection/stabilization to protect the general public as well as the job site. The CONTRACTOR shall revegetate embankments after grading. CONTRACTOR shall submit an embankment protection plan for DISTRICT approval.
- B. Temporary staging, laydown, and parking areas to be determined in coordination with and subject to approval by the DISTRICT and County staff. All areas to be located within the Parcel Boundary depicted in the project drawing, unless otherwise acceptable to the DISTRICT and County.

1.04 WORK PERFORMED BY OTHERS:

- A. Before starting his work and from time to time as work progresses, any sub-contractor's superintendent shall examine work and materials installed by others insofar as they apply to his own work and shall notify the Engineer immediately in writing of conditions which will prevent satisfactory results from the design and specifications.

1.05 CONTRACTOR'S USE OF PREMISES:

- A. During construction activities, the CONTRACTOR shall be responsible for maintaining all access roads in good condition, including grading and drainage.

1.06 DISTRICT'S USE OF PREMISES:

- A. Partial DISTRICT Occupancy: The DISTRICT reserves the right to occupy and to place and install equipment in areas of the Project, prior to Substantial Completion provided that such occupancy does not interfere with completion of the WORK. Such placing of equipment and partial occupancy shall not constitute acceptance of the WORK.

1.07 WORK SEQUENCE, COORDINATION ACTIVITIES AND SCHEDULED DATES:

- A. General: The CONTRACTOR shall coordinate its WORK with other adjacent contractors, landowners and DISTRICT activities, with specific attention to access and staging areas. Construction sequence shall be determined by CONTRACTOR subject to the following needs for continuous access and operation by others.

- B. Suggested Construction Sequence: A suggested sequence of construction has been prepared by the Design Engineer and is presented in the Contract Documents. The CONTRACTOR may suggest modifications to the sequence provided the access and operation requirements are satisfied and compliance with the overall contract period is achieved. A detailed dewatering plan shall be prepared and submitted prior to any dewatering activities.
- C. Scheduled Events: Schedule the WORK to conform to the following events and dates, and to provide for coordination with the WORK performed by others. Work to be conducted in the dry season. Prestressed concrete piles and gates may require lengthy fabrication lead times. CONTRACTOR to coordinate with the manufacturer at project start to avoid construction delays due to manufacture fabrication lead times.
1. Pre-construction meeting and coordination with adjacent landowners
 2. Determine Prestressed Concrete Pile and gate fabrication lead times and adjustments to schedule, as needed
 3. Establish temporary erosion and turbidity control measures
 4. Conduct survey stakeout
 5. Dewater construction area with DISTRICT approval
 6. Demolish existing weir within limits shown on the plans
 7. Metallization of existing weir structure
 8. Install prestressed concrete piles, pile cap, gate support structure, cap seal and gates
 9. Construct retaining wall and regrade channel per plan
 10. Construction concrete slope pavement and rip-rap
 11. Install restoration sodding for bank stabilization
 12. Remove dewatering measures
 13. Construct new catwalk with appenditures and I-beam with surveyed staff gauge
 14. Modify electrical/SCADA services for new gate/actuator configuration
 15. As-built survey record drawings
- D. Bypass Flows: A flow bypass system is not needed for this project as another nearby structure is able to divert excess flow.

1.08 LIST OF DRAWINGS:

- A. Contract Drawings:
1. The drawings for the work are known as: CONSTRUCTION PLANS OF PROPOSED TSALA APOPKA GOLF COURSE STRUCTURE MODIFICATION (C680)
- B. Reference Materials:
1. The following reference materials are available for inspection at the offices of the DISTRICT: These materials are for reference only, are provided as-is, are not contractual documents, and do not replace the CONTRACTOR's due diligence in bid preparation.
 - a. Preliminary Design Assessment Report, which incorporates:
 - i. Golf Course Structure Profile (revised 2012) provided by the DISTRICT
 - ii. Inspection Report by Bolt Underwater, Services, Inc.
 - iii. Report of Geotechnical Engineering Services by Tierra, Inc.
 - iv. Engineering Site Visit Investigation and Photos by AIM Engineering & Surveying, Inc.
 - b. Hydrographic/Topographic Survey Report by AIM Engineering & Surveying, Inc.

END OF SECTION

SECTION 01050 FIELD ENGINEERING

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work:

1. The CONTRACTOR shall engage a Professional Engineer of the discipline required, registered in the State of Florida, to perform engineering services for temporary facilities including the design of shoring systems, shores, earth and water retaining systems, forms, temporary erection supports, and similar items provided by the CONTRACTOR as part of its means and methods of construction.
2. The CONTRACTOR shall engage a Professional Surveyor and Mapper registered in the State of Florida to perform the necessary layout, survey control and monumentation.
3. The CONTRACTOR shall provide one set of As-Built Drawings depicting all elevations NAVD 88 (North American Vertical Datum 88).

B. Related Work Specified Elsewhere:

1. SECTION 01300 - Submittals
2. SECTION 01700 – Contract Closeout
3. SECTION 02200 – Earthwork
4. SECTION 02781 – Staff Gauges

1.02 SUBMITTALS:

- A. Submit in accordance with SECTION 01300.

PART 2 - CONTRACTOR CONSTRUCTION STAKING

2.01 DESCRIPTION: In connection with this WORK, CONTRACTOR shall:

- A. Perform all construction layout and reference staking necessary for the proper control and satisfactory completion of the WORK.
- B. Run a level circuit between vertical control points indicated to check plan benchmarks and establish new benchmarks where necessary.

2.02 CONSTRUCTION REQUIREMENTS:

- A. The CONTRACTOR's personnel performing the construction staking shall work under the direct supervision of a Florida licensed Professional Engineer or Florida licensed Professional Surveyor and Mapper. Submit name and address of individual responsible for surveying to the DISTRICT prior to start of survey activities.
- B. The CONTRACTOR shall be solely and completely responsible for the accuracy of the line and grade of all features of the WORK. Any errors or apparent discrepancies found in previous surveys, plans, or specifications shall be called to the attention of the DISTRICT by the CONTRACTOR for correction or interpretation prior to proceeding with the WORK.
- C. Field notes shall be kept in standard, bound field notebooks in a clear, orderly, and neat manner consistent with standard engineering and/or surveying practices.
- D. The CONTRACTOR shall be responsible for the placement and preservation of adequate ties and reference to all control points, whether established by him or found on the Project, necessary for the accurate reestablishment of all base lines or centerlines shown on the Drawings. All land ties (i.e. section corners, fractional section corners, and similar items) that may be lost or destroyed during construction shall be carefully referenced and replaced.

- E. The supervision of the CONTRACTOR's construction engineering personnel shall be the responsibility of the CONTRACTOR; any deficient engineering layout or construction WORK which may be the result of inaccuracies in his staking operations or of his failure to report inaccuracies found in WORK previously done by the Design Engineer shall be corrected at the expense of the CONTRACTOR.
- F. Station Identification: On linear elements of construction (such as levees, canals, and similar items) the CONTRACTOR shall place temporary identifying signs at intervals no greater than 500 feet using four (4) foot sections of one (1) inch by four (4) inches lumber driven into the ground. The signs shall identify the station at that location.
- G. In order to expedite the commencement of construction operations, the staking operation may commence prior to the issuance of the Notice to Proceed. The CONTRACTOR shall obtain written approval of the DISTRICT prior to commencing staking.

2.03 SURVEYING STANDARDS for stilling wells and water control structures:

- A. A permanent mark shall be established identifying the elevation measuring point on the rim of all stilling wells.
 - 1. All vertical elevations shall commence from a minimum of two (2) National Geodetic Survey (NGS) second order or better published benchmarks.
 - 2. All elevations shall be established to NGS third order standards and certified to those standards by a Professional Surveyor and Mapper registered in the State of Florida.
 - 3. All level runs shall be double run (forward and back) or looped into two (2) NGS second order or better published benchmarks.
 - 4. A Site benchmark shall be set if one does not exist. The benchmark shall consist of a minimum of two (2) 80-pound bags of concrete mix, a ferrous piece of material able to be located with a magnetic locator, and a survey cap (supplied by the DISTRICT) stamped with the Site designation or DISTRICT approved alternative.
 - 5. All elevations shall be established in NAVD 88 with the datum offset for conversion to NGVD 29. Datum offsets shall be made using the CORPSCON 6.0.1 or the most recent version. The datum conversion to NGVD 29 shall be made from the closest bench mark. The NGVD 29 conversions shall be accurate to 0.01 feet.
 - 6. State Plane Coordinates (NAD 83/99) shall be established at all stilling well and benchmark locations with a positional accuracy of +/- three feet.
 - 7. A DISTRICT benchmark description sheet shall be completed for each set benchmark.
- B. All structures shall have a permanent benchmark mounted as shown on the Drawings. The marker for the benchmark can be obtained from the DISTRICT Survey & Mapping Section, (352) 796-7211. The CONTRACTOR shall only stamp or engrave the benchmark identification and not the elevation.
- C. The CONTRACTOR shall install staff gauge in accordance with SECTION 02781.

2.04 RECORDS AND SUBMITTALS:

- A. Submittal:
 - 1. Provide DISTRICT a copy of the designs described in Paragraph 1.01 signed and sealed by the Florida registered Professional Engineer.
 - 2. Provide DISTRICT the data required for the individual responsible for layout and records as required in Paragraph 2.02 A.
 - 3. Provide DISTRICT one (1) copy of the Preliminary Surveyor's Report (MS Word), and two (2) copies of the final signed, sealed and certified Surveyor's Report to the DISTRICT.
 - a. At a minimum, the report shall include: an overall Project description, location sketches, field notes, equipment used, pictures and an NAD 83/99 state plane coordinate (RTK) on each new bench mark (if applicable).
 - b. A CD containing: Surveyor's name and logo, Surveyor's Report, digital pictures, benchmark description sheets and any other associated data.

- B. Records: At the end of the Project, submit to the DISTRICT a certified Site survey showing coordinates and elevations of the completed WORK. These are part of the record documents required in SECTION 01700.
- C. Cross-sections: Cross-sections shall be submitted as specified in SECTION 02200.

END OF SECTION

SECTION 01065 PERMITS AND FEES

PART 1 - GENERAL

- 1.01 Unless otherwise specified, the CONTRACTOR shall obtain and pay for any permits and licenses related to the work as provided for in the Contract Documents, except as otherwise provided herein.
- 1.02 The CONTRACTOR will be issued copies of all permits obtained by the DISTRICT at the pre-construction conference. A copy of the permits shall be posted at the site at all times during construction. The CONTRACTOR shall be responsible for familiarizing himself with the permits and shall abide by the permit conditions at all times.
- 1.03 Work shall be conducted, and shall result in construction of the improvements of this project, in full accordance with the conditions of the permits granted for the project.

END OF SECTION

SECTION 01071 STANDARD REFERENCES

Wherever used in the project manual, the following abbreviations will have the meanings listed:

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| AA | Aluminum Association Incorporated 818 Connecticut Avenue, NW Washington, DC 20006 |
| AABC | Associated Air Balance Council 1518 K Street NW Washington, DC 20005 |
| AAMA | American Architectural Manufacturers Association 2700 River Road, Suite 118 Des Plaines, IL 60018 |
| AASHTO | American Association of State Highway and Transportation Officials 444 North Capitol Street, NW, Suite 225 Washington, DC 20001 |
| ABMA | American Bearing Manufacturers Association 2025 M Street, NW Suite 800 Washington, DC 20036 |
| ACI | American Concrete Institute 38800 Country Club Drive Farmington Hills, MI, 48331 |
| AEIC | Association of Edison Illuminating Companies 600 18 th Street N Birmingham, Al 35203 |
| AFBMA | Anti-Friction Bearing Manufacturers Association |
| AGA | American Gas Association 400 N. Capital Street, NW Suite 450 Washington, DC 20001 |
| AGMA | American Gear Manufacturer's Association 500 Montgomery Street, Suite 350 Alexandria, VA 22314 |
| AHA | American Hardboard Association 1210 West Northwest Hwy Palatine, IL 60067 |
| AISC | American Institute of Steel Construction One East Wacker Drive, suite 700 Chicago, IL 60601 |
| AISI | American Iron and Steel Institute 1000 16th Street, NW Washington, DC 20036 |

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| AITC | American Institute of Timber Construction 333 West Hampden Avenue Englewood, CO 80110 |
| ALSC | American Lumber Standards Committee P. O. Box 210 Germantown, MD 20874 |
| AMCA | Air Movement and Control Association, Inc. 30 West University Drive Arlington Heights, IL 60004 |
| ANSI | American National Standards Institute, Inc. 25 West 43 rd Street New York NY 10036 |
| APA | American Plywood Association P.O. Box 11700 Tacoma, WA 98411 |
| API | American Petroleum Institute 1220 L Street, NW Washington, DC 20005 |
| AHRI | Air-Conditioning Heating and Refrigeration Institute 1814 North Fort Myer Drive Arlington, VA 22209 |
| ASCE | American Society of Civil Engineers 345 East 47th Street New York, NY 10017 |
| ASCII | American Standard Code for Information Interchange United States of America Standards Institute 10 East 40th Street New York, NY 10016 |
| ASE | American Standard Safety Code for Elevators, Dumbwaiter and Escalators American National Standards Institute/ASME A17.1/CSA B44 1430 Broadway New York, NY 10018 |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers United Engineering Center 1791 Tullie Circle, N.E. Atlanta, GA 30329 |
| ASME | American Society of Mechanical Engineers Three Park Avenue New York, NY 10016 |
| ASTM | American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103 |

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| AWPA | American Wood Preservers Association P.O. Box 361784 Birmingham, AL 35236 |
| AWPB | American Wood Preservers Bureau 7962 Conell Court P. O. Box 5283 Lorton, VA 22079 |
| AWPI | American Wood Preservers Institute 1945 Old Gallows Road, Suite 150 Vienna, VA 22182 |
| AWI | Architectural Woodwork Institute 46179 Westlake Drive, Suite 120 Potomac Falls, VA 20165 |
| AWS | American Welding Society 550 NW Lejune Road Miami, FL 33126 |
| AWWA | American Water Works Association 6666 West Quincy Avenue Denver, CO 80235 |
| BHMA | Builders Hardware Manufacturers Association 355 Lexington Avenue, 17 th Floor New York, NY 10017 |
| BOCA | Building Officials and Code Administrators 17926 Halstead Homewood, IL 60430 |
| CBMA | Certified Ballast Manufacturers Association 2120 Keith Building Cleveland, OH 44115 |
| CMAA | Crane Manufacturers Association of America (Formerly called: Overhead Electrical Crane Institute) (OECI) 8720 Reds Oak Boulevard, Suite 201 Charlotte, NC 28217 |
| CRSI | Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173 |
| CSA | Canadian Standards Association 155 Queen Street, Suite 1300 Ottawa, Ontario, CA K1P6L1 |
| DEMA | Diesel Engine Manufacturer's Association 122 East 42nd Street New York, NY 10017 |

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| DHI | Door Hardware Institute 14150 Newbrook Drive, Suite 200 Chantilly, VA 20151 |
| DIS | Division of Industrial Safety California Department of Industrial Relations 2422 Arden Way Sacramento, CA 95825 |
| EEI | Edison Electric Institute 701 Pennsylvania Avenue, NW Washington, DC 20004 |
| EIA | Electronic Industries Alliance 2001 Eye Street, NW Washington, DC 20006 |
| EJMA | Expansion Joint Manufacturer's Association 25 North Broadway Tarrytown, NY 10591 |
| EPA | Environmental Protection Agency Region 4 Sam Nunn Atlanta Federal Center 61 Forsyth Street, SW Atlanta, GA 30303-3104 |
| ESO | Electrical Safety Order, California Administrative Code, Title 8, Chap. 4, Subarticle 5 Office of Procurement, Publications Section P. O. Box 20191 8141 Elder Creek Road Sacramento, CA 95820 |
| FAC | Florida Administrative Code |
| FDEP | Florida Department of Environmental Protection 3900 Commonwealth Boulevard, M.S. 49 Tallahassee, Florida 32399 |
| FEDSPEC | Federal Specifications General Services Administration Specification and Consumer Information Distribution Branch Washington Navy Yard, Bldg. 197 Washington, DC 20407 |
| FEDSTDS | Federal Standards (see FEDSPECS) |
| FM | Factory Mutual Research 1151 Boston-Providence Turnpike Norwood, MA 02062 |
| GANNA | Glass Association of North America 800 SW Jackson Street, Suite 1500 Topeka, Kansas 66612 |

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| HEI | Heat Exchange Institute 1300 Summer Avenue Cleveland, OH 44115 |
| HI | Hydraulic Institute 1230 Keith Building Cleveland, OH 44115 |
| HPVA | Hardwood Plywood and Veneer Association 1825 Michael Faraday Drive Reston, VA 20190 |
| IAPMO | International Association of Plumbing and Mechanical Officials 5001 E. Philadelphia Street Ontario, CA 91761 |
| ICBO | International Conference of Building Officials 5360 South Workman Mill Road Whittier, CA 90601 |
| ICEA | Insulated Cable Engineers Association P. O. Box P South Yarmouth, MA 02664 |
| ICRI | International Concrete Repair Institute 10600 West Higgins Road, Suite 607 Rosemont, IL 60018 |
| IEEE | Institute of Electrical and Electronics Engineers, Inc. 3 Park Avenue, 17 th Floor New York, NY 10016-5997 |
| IES | Illuminating Engineering Society c/o United Engineering Center 120 Wall Street Floor 17 New York, NY 10005 |
| ISA | Instrument Society of America 67 Alexander Drive Research triangle Park, NC 27709 |
| ISO | International Organization for Standardization 1, ru de Varembe, Case Postale 56 CH-1211 Genna 20, Switzerland |
| JIC | Joint Industrial Council 7901 Westpark Drive McLean, VA 22101 |
| MFMA | Metal Framing Manufacturers Association 401 Michigan Avenue Chicago, IL 60611 |

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| MILSPEC | Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120 |
| MSS | Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park Avenue, N.E. Vienna, VA 22180 |
| NAAMM | National Association of Architectural Metal Manufacturers 800 Roosevelt rd bldg C, Suite 312 Glen Ellyn, IL 60137 |
| NACE | National Association of Corrosion Engineers P. O. Box 986 Katy, TX 77450 |
| NEC | National Electrical Code National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210 |
| NECA | National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814 |
| NELMA | Northeastern Lumber Manufacturers Association, Inc. 272 Turtle Road P. O. Box 87A Cumberland Center, ME 04021 |
| NEMA | National Electrical Manufacturer's Association 1300 N. 17 th Street, Suite 1752 Rosslyn, VA 22209 |
| NESC | National Electric Safety Code American National Standards Institute 1430 Broadway New York, NY 10018 |
| NETA | InterNational Electrical Testing Association 3050 Old Centre Avenue, Suite 102 Portage, MI 49024 |
| NFP | National Forest Products Association (Formerly National Lumber Manufacturer's Association) 1619 Massachusetts Avenue Washington, DC 20036 |
| NFPA | National Fire Protection Association Batterymarch Park Quincy, MA 02269 |
| NHLA | National Hardwood Lumber Association P. O. Box 34518 Memphis, TN 38184-0518 |

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| NIST | National Institute of Standards and Technology 100 Bureau Drive, Suite 1070 Gaithersburg, MD 20899-1070 |
| NSF | National Sanitation Foundation P.O. Box 130140 789 N. Dixoboro Road Ann Arbor, MI 48113 |
| OSHA | Occupational Safety and Health Act U.S. Department of Labor Occupational and Health Administration San Francisco Regional Office 200 Constitution Avenue Washington, DC 20210 |
| PCI | Prestressed Concrete Institute 200 W. Adams Street, Suite 2100 Chicago, IL 60606 |
| PPIC | The Plumbing & Piping Industry Council, Inc. 135 Calle Catalina Place Houston, TX 77007 |
| RIS | Redwood Inspection Service California Redwood Association 818 Grayson Road, Suite 201 Pleasant Hill, CA 94523 |
| RLM | Reflector and Lamp Manufacturers Standard Institute |
| RMA | Rubber Manufacturers Association 1400 K Street Washington, DC 20005 |
| SAE | Society of Automotive Engineers 400 Commonwealth Drive Warrendale, PA 15096 |
| SBC | Standard Building Code Published by SBCCI |
| SMC | Standard Mechanical Code Published by SBCCI |
| SBCCI | Southern Building Code Congress International 1116 Brown-Marx Building Birmingham, AL 35203 |
| SCMA | Southern Cypress Manufacturers Association 805 Sterick Bldg. Memphis, TN 38103 |

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| SDI | Steel Door Institute 30200 Detroit road Westlake, OH 44145 |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association, Inc. 4201 Lafayette Center Drive Chantilly, VA 20151 |
| SPC | Society for Protective Coatings 40 24 th Street, 6 th Floor Pittsburgh, PA 15222 |
| SPI | Society of the Plastics Industry, Inc. 1667 K Street, NW Suite 1000 Washington, DC 20006 |
| SPIB | Southern Pine Inspection Bureau P.O. Box 10915 Pensacola, FL 32524 |
| SSPC | The Society for Protective Coatings (formerly called: Steel Structures Painting Council) 40 24 th Street, 6 th Floor Pittsburgh, PA 15222-4656 |
| SSPWC | Standard Specifications for Public Works Construction Building News, Inc. 3055 Overland Avenue Los Angeles, CA 90034 |
| TEMA | Tubular Exchanger Manufacturer's Association 3251 Corte Malpaso, Suite 507 Camarillo, CA 93012 |
| UL | Underwriters Laboratories Inc. 2600 NW Lake Road Camas, WA 98607 |
| USBR | Bureau of Reclamation U.S. Department of Interior Engineering and Research Center Denver Federal Center, Building 67 Denver, CO 80225 |
| USACE | United States Army Corps of Engineers Jacksonville District P. O. Box 4970 Jacksonville, FL 32232-0019 |
| WCLIB | West Coast Lumber Inspection Bureau 6980 SW Varns Street P. O. Box 23145 Tigard, OR 97223 |

WWPA

Western Wood Products Association
(Formerly called: West Coast Lumbermen's Association (WCLA))
522 SW 5th Avenue, Suite 500
Portland, OR 97204

END OF SECTION

SECTION 01150

MEASUREMENT AND PAYMENT

1.1 GENERAL

- A. All pay items under this contract shall be paid for in accordance with this section.
- B. Contingency Allowance: The Contractor shall not use Contingency Allowance without written approval from the Owner.
- C. The Contractor shall accept compensation provided under the terms of this Contract as full payment for furnishing all materials and for performing all work contemplated and embraced under this Contract. Such compensation shall also be for any and all loss or damage arising out of the nature of the work, or from the action of the elements, or from any unforeseen difficulties or obstruction encountered during the Contract period until final acceptance by the Owner.
- D. The Contractor shall prepare and submit a Schedule of Values and Progress Schedule to the Engineer for approval. The Schedule of Values and Progress Schedule shall be the primary means of control of the Work and will be the basis for scheduling all work and for determination of progress payments. The Schedule of Values shall subdivide the work into its component parts for each lump sum pay item below in sufficient detail to serve as the basis for estimating percent complete to support progress payments during construction. An unsupportable or unreasonable allocation of the contract lump sum price to any one of the activities and/or work items shall be justification for the rejection of the Schedule of Values. The total sum of the individual values in the Schedule of Values for each of the activities shall equal the total lump sum contract price minus contingency.
- E. Any item not indicated in the Bid Response Form but shown on the plans, shall be included as part of the lump sum quantity for Mobilization.
- F. It is the Contractor's responsibility to perform a detailed quantity take-off from the plans to determine actual quantities for ordering and delivery purposes. The Owner will not be responsible for quantities ordered in excess of those installed and constructed.
- G. The Owner shall withhold a retainage on each progress payment in accordance with the contract documents. Retainage shall be released to the Contractor upon satisfaction of all contractual obligations and the final acceptance of the completed work by the Owner.
- H. The Contractor shall consider both the construction plan set in conjunction with the technical specifications and contract documents in developing their bid. As specified in 1.1.E above, the cost for any item that is identified on the construction plans, but not included in the Bid Response Form shall be included in the lump sum quantity for Mobilization.

1.2 PAY ITEM DESCRIPTIONS

- A. MOBILIZATION

1. General: The work specified under this section shall consist of the preparatory work and operations necessary to mobilize and begin work on the project. This shall include, but is not limited to, those operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; the establishment of temporary offices, buildings, safety equipment and first-aid supplies, sanitary and other facilities required by these Contract documents; compliance with all applicable federal, state and local regulations; preparation and implementation of a stormwater pollution prevention plan; and all project documentation, including but not necessarily limited to video photography and aerial photography, specified by these Contract documents. This item also includes installation of project signage.

The cost of Bonds and any other required insurance, consideration for indemnification to the Owner and the Engineer, and any other pre-construction expenses necessary for the start of the work, excluding the cost of construction materials, shall also be included in this section.

2. Payment: The work specified under this section shall be paid for at the Contract lump sum price for Mobilization and shall be in accordance with the following schedule:

| PERCENT OF ORIGINAL CONTRACT AMOUNT EARNED | ALLOWABLE PERCENT OF THE LUMP SUM PRICE FOR MOBILIZATION |
|--|--|
| 5 | 25 |
| 10 | 50 |
| 25 | 75 |
| 50 | 100 |

Partial payment shall be limited to ten percent (10%) of the original Contract amount for the project. Any remaining amount will be paid upon completion of all work on the project, including final punchlist work items. The applicable work specified under this section shall be paid for under the following Pay Item (and/or other similar project specific phasing):

- Mobilization/Demobilization

B. CLEARING AND GRUBBING

1. General: The work specified under this section shall consist of the removal and disposal of all existing structures and buildings including foundations, utilities and septic tanks, timber and brush except where otherwise indicated, stumps and roots, existing pavement, and all debris in all areas where work on excavations, embankments, pavements and structures (including pipe culverts and other pipelines) is to be done as shown or reasonably implied in the drawings and in accordance with the specifications.

2. Payment: The pay quantity for Clearing and Grubbing shall be lump sum which shall include all work and materials described above. The applicable work specified under this section shall be paid for under the following Pay Item:

- Clearing and Grubbing

C. EROSION CONTROL DEVICES AND TURBIDITY BARRIER

1. General: The work specified under this section shall include furnishing all labor and materials to install, inspect and maintain the erosion control and/or turbidity barriers surrounding project work as shown on the drawing. The work shall include anchoring either the floating or staked barrier by 4-inch posts at all ends.
2. Payment: The pay quantities for the work specified under this section shall be lump sum. The work specified under this section shall be paid for under the following Pay Item:
 - Temporary Erosion Control

D. DEWATERING

1. General: The work specified under this section shall consist of all dewatering, bypass pumping, and surface water control in accordance with the plans and specifications. All temporary construction including culverts, pipe, berms, and channels is included in this pay item. This pay item includes all required permits for dewatering. Erosion protection associated with dewatering activities and bypass pumping shall be included in this pay item. Removal of dewatering and bypass pumping equipment, associated temporary facilities, and site restoration of areas impacted by dewatering and bypass pumping shall be included in this pay item.
2. Payment: The pay quantity for Dewatering shall be one lump sum quantity which shall include all work and materials described above. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Dewatering

E. EARTHWORK

1. General: The work specified under this section shall consist of excavating, filling, compacting, and grading all embankments, channels, subgrades, shoulders, and side slopes in accordance with the alignment, grade and cross-sections shown or reasonably implied in the drawings and in accordance with the specifications. Work shall include all compaction testing required by the plans and specifications. Work shall also include furnishing fill (borrow) materials, hauling and disposal of all excess material, and hauling and disposal of all unsuitable materials. Specifically excluded is all earthwork associated with underground utility installations including stormsewers and storm structures with the exception of encountered solid waste.
2. Payment: The pay quantities for work specified under this section shall be lump sum. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Earthwork

F. PRESTRESSED CONCRETE PILES

1. General: The work specified under this section shall consist of all labor, equipment and materials to install 14” prestressed concrete piles as shown on the plans. All concrete material to be used under this item shall conform to the specifications provided and as specified in the Plans.
2. Payment: The pay quantities for work specified under this section shall be linear feet. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Prestressed Concrete Piles – 14”

G. CONCRETE CAP AND GATE SUPPORT STRUCTURE

1. General: The work specified under this section shall consist of all labor, equipment and materials to install reinforcement rebar, concrete cap, gate support structure, concrete cap seal painting and other incidentals shown on the plans. All concrete material to be used under this item shall conform to the specifications provided and as specified in the Plans.
2. Payment: The pay quantities for work specified under this section shall be lump sum. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Concrete Cap and Gate Support Structure

H. METALLIZATION

1. General: The work specified under this section consists of furnishing all labor and materials to metalize existing weir sheet piling, catwalks and railings as indicated on the plans. This item shall include all materials, quality control, qualifications, equipment, surface preparation, application, environmental requirements, health and safety requirements, waste handling and management, testing and properly disposing of all necessary material, and other incidentals to perform the work.
2. Payment: The pay quantities for work specified under this section shall be lump sum. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Metallization of Existing Structure

I. COATING (Alternate at owner’s Option in lieu of Metallization)

1. General: The work specified under this section consists of furnishing all labor and materials to coat the existing weir sheet piling, catwalks and railings as indicated on the plans. This item shall include all materials, quality control, qualifications, equipment, surface preparation, application, environmental requirements, health and safety requirements, waste handling and management, testing and properly disposing of all necessary material, and other incidentals to perform the work. Coating shall consist of one (1) coat of Tnemec Series 90-98 Primer and one (1) coat of epoxy overcoat, or approved equal.

2. Payment: No payment shall be made for this item without prior authorization from the District. The pay quantities for work specified under this section shall be lump sum. The applicable work specified under this section shall be paid for under the following Pay Item:

- Coating of Existing Sheet Piling and Catwalk

J. RETAINING WALL

1. General: The work specified under this section consists of furnishing all labor and materials to install the retaining wall as indicated on the plans.

2. Payment: The pay quantities for work specified under this section shall be lump sum. The applicable work specified under this section shall be paid for under the following Pay Item:

- Retaining Wall

K. ALUMINUM SLIDE GATES AND ELECTRIC OPERATORS

1. General: The work specified under this section consists of furnishing all labor, equipment and materials to install operable aluminum slide gates of the size and type called for on the plans, including: Electric actuators manufactured by Limatorque, Inc.; slide gates, frames, stem connectors, stem guides, adapter plates, anchors, brackets, etc. manufactured by Whipps, Inc., or District approved equivalent.

2. Payment: The pay quantities for work specified under this section shall be per each. The applicable work specified under this section shall be paid for under the following Pay Item:

- Aluminum Slide Gates and Electric Operators

L. ELECTRICAL MODIFICATIONS

1. General: The work specified under this section consists of furnishing all labor, equipment, materials, and permits necessary to coordinate with the local electric utility. Electrical work shall include all conduits, switchgear, controls and equipment boxes modifications necessary for the new electric gate actuators integration with the DISTRICT'S SCADA system. Electrical work shall be installed according to the schematic and details provided on the plans and in accordance with all applicable regulatory and building codes.

2. Payment: The pay quantities for work specified under this section shall be per lump sum. The applicable work specified under this section shall be paid for under the following Pay Item:

- Electrical Modifications

M. ALUMINUM GRATE CATWALK WITH HANDRAIL

1. General: The work specified under this section consists of furnishing all labor, equipment and materials necessary to furnish and install the 36" wide aluminum catwalk with non-slip grating, 2" diameter aluminum handrailing, supports, brackets, anchors, kickplates, security barrier, ladders etc. as shown on the plans and in accordance with manufacturer's recommendations.
2. Payment: The pay quantities for work specified under this section shall be per lump sum. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Aluminum Grate Catwalk with Handrail – 36" Wide

N. RIP-RAP

1. General: The work specified under this section consists of furnishing all labor, equipment and materials necessary to construct the Rip-Rap to line and grade as shown on the plans. The Rip-Rap is to have a thickness of 2.5 feet with a minimum specific gravity of 2.3 and shall include a fabric filter carefully and properly placed beneath.
2. Payment: The pay quantities for work specified under this section shall be per cubic yards. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Rip-Rap

O. CONCRETE SLOPE PAVEMENT

1. General: The work specified under this section consists of furnishing all labor, equipment and materials necessary to install 8" thick reinforced concrete slope pavement to support the canal embankment as shown on the plans.
2. Payment: The pay quantities for work specified under this section shall be per square yards. The applicable work specified under this section shall be paid for under the following Pay Item:
 - Concrete Slope Pavement

P. SODDING

1. General: The work specified under this section consists of furnishing all labor and materials to sod all areas indicated on the plans. This item shall include watering and maintenance until the project is accepted by the Owner.
2. Payment: The pay quantity for the work specified under this section shall be unit price per square yard. The work specified under this section shall be paid for under the Pay Item:

- Restoration Sodding

Q. SURVEY

1. General: The work specified under this section consists of construction layout survey and as-built survey by a Florida Licensed Professional Surveyor in the NAVD 88 Datum in accordance with plans and specifications.
2. Payment: The work specified under this section shall be paid for under the lump sum Pay Item:

- Survey (Layout and As-built)

R. CONTINGENCY ALLOWANCE

1. General: The work specified under this section consists of performing additional work beyond the original contract scope as directed by the Owner.
2. Payment: Payment for miscellaneous work outside of the original contract scope will be made only for work specifically authorized by the Owner in writing. Prior to beginning the work, the Owner and Contractor will agree on a unit price or lump sum price for the additional work. The work specified under this section shall be paid for under the Pay Item:

- Contingency Allowance

END OF SECTION

SECTION 01200 PROJECT MEETINGS AND REPORTS

PART 1 - GENERAL

1.01 SUMMARY: This Section includes the following administrative and procedural requirements:

- A. Project Meetings:
 - 1. Preconstruction conference
 - 2. Progress meetings
- B. Schedules and Reports:
 - 1. Initial coordination submittals
 - 2. Construction progress schedule (See SECTION 01310 Construction Schedules)
 - 3. Special reports

1.02 PROJECT MEETINGS:

- A. Pre-construction Conference
 - 1. The DISTRICT will administer a meeting within 10 days after the Effective Date of the Agreement, to review items stated in the following agenda and to establish a working understanding between the parties as to their relationships during conduct of the Work.
 - 2. Preconstruction conference shall be attended by:
 - a. CONTRACTOR and his superintendent
 - b. Representatives of principal Subcontractors and Suppliers
 - c. Engineer and his Resident Project Representative if any
 - d. DISTRICT or its representative
 - e. Other affected parties determined by the DISTRICT
 - 3. Agenda:
 - a. Projected construction schedules
 - b. Critical Work sequencing
 - c. Designation of responsible personnel
 - d. Project coordination
 - e. Procedures and Processing of:
 - i. Field decisions
 - ii. Substitutions
 - iii. Submittals
 - iv. Change Orders
 - v. Applications for payment
 - f. Procedures for testing
 - g. Procedures for maintaining record documents
 - h. Use of Premises:
 - i. Office, work and storage areas

- ii. DISTRICT'S requirements
 - i. Construction facilities, controls, and construction aids
 - j. Temporary utilities
 - k. Safety and first aid
 - l. Security
 - m. Requirements of any permits obtained by the DISTRICT
 - 4. Location of Meeting: Southwest Florida Water Management District (2379 Broad Street, Brooksville, FL 34604)
- B. Progress Meetings:
1. The DISTRICT will administer a meeting a minimum of twice each month (every two weeks) and at other times requested by the DISTRICT. CONTRACTOR, Engineer and all Subcontractors active on the site shall be represented at each meeting. CONTRACTOR may request attendance by representatives of his Suppliers and other Subcontractors, or other entities concerned with current program or involved with planning, coordination or performance of future activities. All participants in the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
 2. CONTRACTOR and each Subcontractor shall be prepared to discuss the current construction progress report, any anticipated future changes to the schedule, and advise if their current progress or future anticipated schedules are compatible with the Work.
 3. If one Subcontractor is delaying another, CONTRACTOR shall direct such changes as are necessary for those involved to mutually agree on schedule changes in the best interest of construction progress.
 4. Agenda
 - a. Review of construction progress since previous meeting
 - b. Field observations, interface requirements, conflicts
 - c. Problems which impede construction schedule
 - d. Off-site fabrication
 - e. Delivery schedules
 - f. Submittal schedules and status
 - g. Site utilization
 - h. Temporary facilities and services
 - i. Hours of Work
 - j. Hazards and risks
 - k. Housekeeping
 - l. Quality and Work standards
 - m. Change orders
 - n. Documentation of information for payment request
 - o. Corrective measures and procedures to regain projected schedule if necessary
 - p. Revisions to construction schedule
 - q. Progress and schedule during succeeding Work period

- r. Review proposed changes for:
 - i. Effect on construction schedule and on completion date
 - ii. Effect on other contracts of the Project
 - s. Other business
5. Location of Meetings: DISTRICT Office (2379 Broad Street, Brooksville, FL 34604), the project site, or other DISTRICT pre-approved location.
 6. Reporting: After each meeting, minutes of the meeting will be distributed to each party present and to parties who should have been present.
- C. Special Reports:
1. When an event of an unusual and significant nature occurs at the site, a special report shall be prepared and submitted. List the chain of events, persons participating, response by CONTRACTOR'S personnel, an evaluation of the results or effects, and similar pertinent information. Advise the DISTRICT in advance when such events are known or predictable.

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 - GENERAL

1.01 SCOPE:

- A. This SECTION includes definitions, descriptions, transmittal, and review of "Compliance" and "Miscellaneous" Submittals.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01310 –Construction Schedule

1.02 GENERAL INFORMATION:

- A. Definitions:
 - 1. Compliance Submittals include Shop Drawings, product data, and samples which are prepared by the CONTRACTOR, Subcontractor, MANUFACTURER, or Supplier and submitted by the CONTRACTOR to the DISTRICT as a basis for approval of the use of Equipment and Materials proposed for incorporation in the WORK or needed to describe installation, operation, maintenance, or technical properties.
 - a. Shop Drawings include custom-prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.
 - b. Product data includes standard printed information on materials, products and systems not custom-prepared for this Project, other than the designation of selections from available choices.
 - c. Samples include both fabricated and unfabricated physical examples of materials, products, and WORK; both as complete units and as smaller portions of units of WORK; either for limited visual inspection or (where indicated) for more detailed testing and analysis. Mock-ups are a special form of samples which are too large to be handled in the specified manner for transmittal of sample Submittals.
 - 2. Miscellaneous Submittals are those technical reports, administrative Submittals, certificates, and guarantees not defined as Shop Drawings, product data, or samples.
 - a. Technical reports include laboratory reports, tests, technical procedures, technical records, CONTRACTOR's design analysis and CONTRACTOR's survey field notes for construction staking, before cross-sections and after cross-sections.
 - b. Administrative Submittals are those nontechnical Submittals required by the Contract Documents or deemed necessary for administrative records. These Submittals include maintenance agreements, workmanship bonds, Project photographs, physical work records, statements of applicability, copies of industry standards, as-constructed data, security/protection/safety data, and similar type Submittals.
 - c. Certificates and guarantees are those Submittals on Equipment and Materials where a written certificate or guarantee from the MANUFACTURER or Supplier is called for in the Specifications.
 - d. Reports as required by Contract describing CONTRACTOR's means and methods for items such as dewatering, earth and water retaining, erosion/turbidity control, and safety plans.
 - 3. Refer to ARTICLE 1.03 and 1.04 of this Part for detailed lists of documents and specific requirements.
- B. Quality Requirements:

1. The CONTRACTOR shall submit all Project related correspondences including, but not limited to Request for Information (RFI), Submittals, miscellaneous correspondences, etc. in writing and/or in digital PDF format by electronic transmission to the DISTRICT Project Manager. Submittals that require a professional or corporate seal or certification shall provide one signed and sealed original as well as a copy in digital format.
 2. Submittals such as Shop Drawings and product data shall be of the quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings such as reproducibles shall be useable for further reproduction to yield legible hard copy.
 3. Documents submitted to the DISTRICT that do not conform to these requirements shall be subject to rejection by the DISTRICT, and upon request by DISTRICT, CONTRACTOR shall resubmit conforming documents. If conforming Submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. CONTRACTOR's (or his Subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve CONTRACTOR (or his Subcontractors) from meeting the required schedule for Submittal of Shop Drawings and product data.
- C. Language and Dimensions:
1. All words and dimensional units shall be in the English language.
 2. Metric dimensional unit equivalents may be stated in addition to the English units.
- D. Submittal Completeness:
1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable the DISTRICT to review the information effectively.
 2. Where standard drawings are furnished which cover a number of variations of the general class of equipment, each such drawing shall be individually annotated to describe exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting markers" is not an acceptable means of annotating Submittals. Such annotation shall also include proper identification of the Submittal permanently attached to the drawing.
 3. Reproduction or copies of Drawings or portions thereof will not be accepted as complete fabrication or erection drawings. The CONTRACTOR may use a reproduction of the DISTRICT-prepared Contract Drawings for erection drawings such as to indicate information on erection or to identify detail drawing references. Where the Drawings are revised to show this additional CONTRACTOR information, the DISTRICT's title block shall be replaced with a CONTRACTOR's title block and the DISTRICT's professional seal shall be removed from the Drawing. The CONTRACTOR shall revise these erection drawings for subsequent DISTRICT revisions to the Contract Drawings.

1.03 COMPLIANCE SUBMITTALS:

- A. Items shall include, but not be limited to, the following:
1. MANUFACTURER's specifications
 2. Catalogs, or parts thereof, of manufactured equipment
 3. Shop fabrication and erection drawings
 4. General outline drawings of equipment showing overall dimensions, location of major components, weights, and location of required building openings and floor plates
 5. Detailed equipment installation drawings, showing foundation details, anchor bolt sizes and locations, baseplate sizes, location of DISTRICT's connections, and all clearances required for erection, operation, and disassembly for maintenance.

6. Schematic diagrams for electrical items, showing external connections, terminal block numbers, internal wiring diagrams, and one-line diagrams
 7. Bills of material and spare parts list
 8. Instruction books and operating manuals
 9. Material lists or schedules
 10. Performance tests on equipment by MANUFACTURERS
 11. Concrete mix design information
 12. Samples and color charts
 13. All drawings, calculations, catalogs or parts thereof, MANUFACTURER's specifications and data, samples, instructions, and other information specified or necessary:
 - a. For DISTRICT to determine that the Equipment and Materials conform with the design concept and comply with the intent of the Contract Documents.
 - b. For the proper erection, installation, operation and maintenance of the Equipment and Materials which the DISTRICT will review for general content but not for substance.
 - c. For the DISTRICT to determine what supports, anchorages, structural details, connections, and services are required for the Equipment and Materials, and the effects on contiguous or related structures and Equipment and Materials.
- B. Schedule and Log of Compliance Submittals:
1. Prepare for the DISTRICT, a schedule and log for submission of all Compliance Submittals specified or necessary for DISTRICT's review of the use of Equipment and Materials proposed for incorporation in the WORK or needed for proper installation, operation or maintenance. Submit the schedule and log with the procurement schedule and WORK progress schedule. Schedule submission of all Compliance Submittals to permit review, fabrication, and delivery in time so as to not cause a delay in the WORK of CONTRACTOR or his Subcontractors or any other contractors as described herein.
 2. In establishing schedule for Compliance Submittals, allow fifteen (15) working days in DISTRICT's office for reviewing original Submittals and ten (10) working days for reviewing resubmittals.
 3. The schedule shall indicate the anticipated dates of original submission, and shall be prepared in accordance with SECTION 01310.
 4. Schedule all Compliance Submittals required prior to fabrication or manufacture for submission within **90** days of the Notice to Proceed. Schedule Compliance Submittals pertaining to storage, installation and operation at the Site for DISTRICT's acceptance prior to delivery of the Equipment and Materials.
 5. Resubmit Compliance Submittals the number of times required for DISTRICT's "Submittal Accepted." However, any need for resubmittals in excess of the number set forth in the accepted schedule, or any other delay in obtaining acceptance of Submittals, will not be grounds for extension of the Contract Time, provided the DISTRICT completes its reviews within the times stated above.
- C. Transmittal of Compliance Submittals:
1. All Compliance Submittals and related correspondences shall be submitted to the DISTRICT by CONTRACTOR.
 2. All Compliance Submittals of Equipment and Materials furnished by Subcontractors, MANUFACTURERS, and Suppliers shall be submitted to the DISTRICT by CONTRACTOR electronically in PDF format or in written format.

3. After checking and verifying all field measurements, transmit all Compliance Submittals to the DISTRICT for acceptance as follows:
 - a. Identify each Compliance Submittal by Submittal Number, Project name and number, Contract title and number, and the Specification SECTION and article number marked thereon or in the letter of transmittal. Unidentifiable Submittals will be returned for proper identification.
 - b. Check and stamp Compliance Submittals of Subcontractors, Suppliers, and MANUFACTURERS with CONTRACTOR's approval prior to transmitting them to the DISTRICT. CONTRACTOR's stamp of approval shall constitute a representation to the DISTRICT that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or he assumes full responsibility for doing so, and that he has coordinated each Compliance Submittal with the requirements of the WORK and the Contract Documents.
 - c. At the time of each submission, call to the attention of DISTRICT in the letter of transmittal any deviations from the requirements of the Contract Documents.
 - d. Make all modifications noted or indicated by DISTRICT and return revised prints, copies, or samples until accepted. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by the DISTRICT on previous Submittals. After Submittals have been accepted, submit copies thereof for final distribution. Prints of accepted drawings transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the Submittal and resubmit for review.
 - e. Following completion of the WORK and prior to final payment, furnish those drawings necessary to indicate "as constructed" conditions, including field modifications, in the number of copies specified. Furnish additional copies for insertion in equipment instruction books as required. All such copies shall be clearly marked "AS BUILT DRAWING."
 - f. WORK requiring a Compliance Submittal shall not be commenced or shipped until the Submittal has been stamped "Submittal Accepted" or "Submittal Accepted as Noted" by the DISTRICT.
 - g. Keep a copy or sample of each Compliance Submittal in good order at the Site.
 4. Copies of the equipment CONTRACTOR's erection drawings and other Compliance Submittals required for the installation of equipment furnished by others under separate Contract for installation under this Contract will be transmitted to CONTRACTOR by the DISTRICT in the final distribution of such Submittals.
 5. Information to MANUFACTURER's District Office: MANUFACTURERS and Suppliers of Equipment and Materials shall furnish copies of all agreements, drawings, specifications, operating instructions, correspondence, and other matters associated with this Contract to the MANUFACTURER's district office servicing the DISTRICT. Insofar as practicable, all business matters relative to Equipment and Materials included in this Contract shall be conducted through such local district offices.
- D. DISTRICT's Review:
1. The DISTRICT will review and return Compliance Submittals to CONTRACTOR with appropriate notations. Instruction books and similar Submittals will be reviewed by the DISTRICT for general content but not for substance.
 2. The DISTRICT's acceptance of Compliance Submittals will not relieve CONTRACTOR from his responsibility as stated in the Contract Documents.
- E. Compliance Submittal Action Stamp:

1. The DISTRICT's review action stamp or designation, appropriately completed, will appear on all Compliance Submittals of CONTRACTOR when returned by the DISTRICT. Review status designations listed on DISTRICT's action stamp are defined as follows:
 - a. "ACCEPTED AS SUBMITTED": Signifies Equipment or Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is acceptable for incorporation in the WORK. CONTRACTOR is to proceed with fabrication or procurement of the items and with related WORK.
 - b. "ACCEPTED AS NOTED": Signifies Equipment and Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is acceptable for incorporation in the WORK subject to the condition that as constructed it shall be in accordance with all notations and/or corrections indicated. CONTRACTOR is to proceed with fabrication or procurement of the items and with related WORK in accordance with DISTRICT's notations.
 - c. "RETURNED FOR REVISION": Means that deviations from the requirements of the Contract Documents exist in the submittal. CONTRACTOR is to resubmit revised information responsive to DISTRICT's annotations on the returned Submittal or written in the letter of transmittal. Fabrication or procurement of items represented by the Submittal and related WORK is not to proceed until the Submittal is approved.
 - d. "NOT ACCEPTABLE (SUBMIT ANEW)": Signifies Equipment and Material represented by the Submittal does not conform with the design concept or comply with the intent of the Contract Documents and is disapproved for use in the WORK. CONTRACTOR is to resubmit Compliance Submittals responsive to the Contract Documents.
 - e. "PRELIMINARY SUBMITTAL": Signifies Submittals of such preliminary nature that a determination of conformance with the design concept or compliance with the intent of the Contract Documents must be deferred until additional information is furnished. CONTRACTOR is to submit such additional information to permit layout and related activities to proceed.
 - f. "FOR REFERENCE ONLY": Signifies Submittals which are for supplementary information only; pamphlets, general information sheets, catalog cuts, standard sheets, bulletins and similar data, all of which are useful to the DISTRICT in design, operation, or maintenance, but which by their nature do not constitute a basis for determining that items represented thereby conform with the design concept or comply with the intent of the Contract Documents. The DISTRICT reviews such Submittals for general content but not for substance.
 - g. "DISTRIBUTION COPY (PREVIOUSLY ACCEPTED)": Signifies Submittals which have been previously accepted and are being distributed to CONTRACTOR, DISTRICT, Resident Project Representative, and others for coordination and construction purposes.

F. Instruction Books / Operation & Maintenance Manuals:

1. Equipment instruction books and manuals shall be prepared by the MANUFACTURER and shall include the following:
 - a. Index and tabs
 - b. Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers
 - c. Applicable drawings
 - d. Name of contact person, phone number, and address of the nearest authorized service facility
 - e. Attached to the above shall be a notice of the exact warranty effective dates, beginning and ending.
 - f. All additional data specified

2. Information listed above shall be submitted electronically in a PDF file format and also be bound into hard-back binders of three-ring type. Sheet size shall be 8-1/2 inches x 11 inches. Binder color shall be yellow for Electrical and Electronics and brown for Miscellaneous Equipment. Capacity shall be a minimum of 1-1/2 inches, but sufficient to contain and utilize sheets with ease.
 - a. Instruction Books/Operation & Maintenance Manuals shall contain the following:
 - i. Equipment name
 - ii. MANUFACTURER's name
 - iii. Project name
 - iv. Contract number
 - v. Reference to applicable Drawing No. & Technical Specifications Section
 - b. Format: The overall manual should be constructed around certain types of structures or equipment in the Project, and not merely assembled by technical specification section, so that all pertinent data needed by personnel to operate or maintain the equipment or structure is in one (1) manual (as far as is practical). The CONTRACTOR shall coordinate with the DISTRICT as to how the manuals are to be assembled.

G. Samples:

1. Office samples shall be of sufficient size and quantity to clearly illustrate the following:
 - a. Functional characteristics of the product, with integrally related parts and attachment devices
 - b. Full range of color, texture, and pattern

1.04 MISCELLANEOUS SUBMITTALS:

- A. Miscellaneous Submittals are comprised of technical reports, administrative Submittals, and guarantees which relate to the WORK, but do not require DISTRICT's approval prior to proceeding with the WORK. Miscellaneous Submittals may include but are not limited to (at DISTRICT's discretion):
 1. Field test reports
 2. Concrete cylinder test reports
 3. Certification on Materials:
 - a. Steel mill tests
 - b. Paint lab tests
 - c. Cement tests
 4. Soil test reports
 5. Temperature records
 6. Shipping or packing lists
 7. Job progress schedules
 8. Equipment and Material delivery schedules
 9. Progress photographs
 10. Warranties and guarantees
 11. Surveying field notes, preliminary and final Surveyor's Reports
 12. Pump tests
 13. Traffic control plan

B. Transmittal of Miscellaneous Submittals:

1. All Miscellaneous Submittals furnished by Subcontractors, MANUFACTURERS, and Suppliers shall be submitted to DISTRICT by CONTRACTOR electronically in PDF format where practical, unless otherwise specified.
 - a. Identify each miscellaneous Submittal by Project name and number, Contract title and number, and the specification section and article number marked thereon or in the letter of transmittal. Unidentifiable Submittals will be returned for proper identification.
 - b. Check and stamp Miscellaneous Submittals of Subcontractors, Suppliers, and MANUFACTURERS with CONTRACTOR's approval prior to transmitting them to the DISTRICT. CONTRACTOR's stamp of approval shall constitute a representation to the DISTRICT that CONTRACTOR has either determined and verified all information, or he assumes full responsibility for doing so, and that he has coordinated Miscellaneous Submittal with the requirements of the WORK and the Contract Documents.
 - c. At the time of each submission, call to the attention of the DISTRICT in the letter of transmittal any deviations from the requirements of the Contract Documents.
 - d. Make all modifications noted or indicated by DISTRICT and return revised prints, or copies until accepted. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by the DISTRICT on previous Submittals. After Submittals have been accepted, submit copies thereof for final distribution.
2. Test Reports:
 - a. Responsibilities of CONTRACTOR and DISTRICT regarding tests and inspections of Equipment and Materials and completed WORK are set forth elsewhere in these Contract Documents.
 - b. The party specified responsible for testing or inspection shall in each case, unless otherwise specified, arrange for the testing laboratory or reporting agency to distribute test reports in an electronic PDF file format to the following in addition to submitting test reports electronically to the DISTRICT :
 - i. DISTRICT's Consultant
 - ii. District Project Manager
 - iii. CONTRACTOR
 - iv. MANUFACTURER or supplier

C. DISTRICT'S Review:

1. DISTRICT will review Miscellaneous Submittals for indications of WORK or material deficiencies within fifteen (15) working days in DISTRICT's office for original Submittals and ten (10) working days for reviewing resubmittals.
2. DISTRICT will respond to CONTRACTOR on those Miscellaneous Submittals which indicate WORK or material deficiency.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 SUBMITTAL LOG:

- A. CONTRACTOR shall maintain an accurate Submittal Log and a Distribution List for the duration of the WORK, showing current status of all Submittals and Distributees at all times in a form acceptable

to the DISTRICT. CONTRACTOR shall make the Submittal Log available to the DISTRICT for its review on request, and shall bring a copy of the Submittal Log to all Progress Meetings.

END OF SECTION

SECTION 01310 CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.01 SCOPE:

- A. **CONSTRUCTION SCHEDULE:** The WORK under this Contract shall be planned, scheduled, executed, and reported by the CONTRACTOR. The CONTRACTOR shall adhere to established technical standards for CPM (Critical Path Method) scheduling. The CONTRACTOR is required to provide all Construction Schedules in electronic format.
- B. The CONTRACTOR shall submit a detailed Construction Baseline Schedule (Baseline Schedule) showing all WORK required under the Contract and scheduled within the time constraints set forth under the Contract. The DISTRICT will review and comment on the Baseline Schedule submittal as per 2.03. Upon acceptance, the CONTRACTOR shall not change the accepted Baseline Schedule without prior concurrence of the DISTRICT. The Baseline Schedule shall be updated to show actual progress. Any proposed changes in the schedule activities, original duration, logic, activity constraints, other than progress, shall be incorporated into a request for a revision to the accepted Baseline Schedule and submitted for review and acceptance.
- C. The CONTRACTOR shall be responsible for coordinating its own schedules (including subcontractors) as well as the construction activities of others as required to fully execute the WORK.

1.02 SOFTWARE/INTERFACE REQUIREMENTS:

- A. The CONTRACTOR shall use the latest version of Microsoft Project or approved equivalent for creating and updating all Construction Schedules and reports.

1.03 QUALITY ASSURANCE:

- A. The CONTRACTOR shall perform the WORK covered by this SECTION with personnel having substantial experience in the use of the scheduling software on construction projects which required the development and maintenance of the schedule throughout the Project duration.
- B. It is the responsibility of the CONTRACTOR to work with each subcontractor and supplier to obtain information pertinent to the planning and updating of their respective activities in the schedules.

1.04 DEALING WITH SUBSTITUTES:

- A. All versions of the CONTRACTOR's Construction Schedule shall be based solely on the WORK as awarded, and shall exclude any substitute proposals, even if the CONTRACTOR pursues a substitution in accordance with the provisions of the Contract.
- B. The DISTRICT's final determination on any proposed substitutions may not be made until after the CONTRACTOR's Construction Schedule is prepared and accepted. Accepted proposed substitutions shall be identified in the schedule as Change Orders.

1.05 USE OF FLOAT:

- A. Total Float is the amount of time a scheduled activity can be delayed without delaying the completion of the WORK beyond the contractually required end date. Contract Float is the number of days between the CONTRACTOR's anticipated date for early completion of the WORK, or specified part, and the corresponding Contract Time. Total Float and Contract Float belong to the Project and are not for the exclusive benefit of any party. Contract Float and Total Float shall be available to the DISTRICT, consultants, or the CONTRACTOR to accommodate changes in the WORK or to mitigate the effect of events which may delay performance or completion. The DISTRICT will monitor and optimize the use of float for the benefit of the Project.

1.06 EARLY COMPLETION:

- A. An early completion schedule is one which anticipates completion of all or a specified part of the WORK ahead of the corresponding Contract Time. Since Contract and Total Floats belong to the Project, the CONTRACTOR shall not be entitled to any extension in Contract Time or recovery for any delay incurred because of extensions in an early completion date until all Contract Float is used or consumed and performance or completion of the WORK extends beyond the Contract Time. The accepted Baseline Schedule must have a single longest path with zero Total Float. Multiple longest paths are not acceptable.

1.07 NON-COMPLIANCE:

- A. The DISTRICT may refuse to recommend/authorize a progress payment in the event of the CONTRACTOR's failure, refusal or neglect to provide the required schedule information, since this will preclude the proper evaluation of the CONTRACTOR's progress. Remedies for the CONTRACTOR's failure, neglect or refusal to comply with the requirements of this SECTION are in addition, and not limited to, those provided under other sections of the Contract.

PART 2 - PRODUCTS

2.01 GENERAL CRITERIA:

- A. All Construction Schedules shall be prepared by the CONTRACTOR and reflect the CONTRACTOR's plans, means and methods, techniques and sequences for performing of the WORK.
- B. The Construction Schedules shall break down the WORK into distinct activities with interdependencies to the extent required to clearly depict the planned approach for completion of the WORK and to effectively manage the execution of the WORK.
 - 1. The Construction Schedules shall divide the WORK into manageable and logical segments and specify the progression from the Notice to Proceed (NTP) to Substantial Completion (SC) to Final Completion (FC) within Contract Time.
 - 2. The Construction Schedule is to include, at minimum, appropriate time allowances for submittals, procurement, coordination with others, construction, start-up/check-out (if applicable), operational and performance testing (if applicable), commissioning (if applicable), and Contract Close-Out.
 - 3. Site-related activities shall not reflect a combination of work located in separate structures, work corresponding to different divisions of the specifications, work performed by first and second tier subcontractors or rough-in and finish work of the same trade.
 - 4. The NTP activity shall be the first activity in the schedule and shall be a Start Milestone, with an assigned 7-day, no holiday calendar. The SC and FC activities shall be Finish Milestones, with assigned "Finish on or Before" constraints, with the Contract SC and FC dates assigned to the constraints, with a 7-day, no holiday calendar.
 - 5. The CONTRACTOR's Construction Schedule shall include preparation, review and acceptance of Shop Drawings, material fabrication and material deliveries. The first submittal review and acceptance activity durations shall be fifteen (15) working days. Resubmittal review and acceptance cycles shall have activity durations of ten (10) working days. The CONTRACTOR shall include only the first submittal review and acceptance cycle for each submittal in the Construction schedule. If more than one cycle for a submittal occurs, the CONTRACTOR shall add that cycle to the schedule at the time it occurs. Additional submittal, review and acceptance cycles will require a revision to the Baseline Schedule.
- C. The CONTRACTOR shall schedule any requirements (such as submittal reviews) of the DISTRICT, the DESIGN CONSULTANT and others (performing WORK for the DISTRICT) indicated in, or required by the Contract Documents. The Construction Schedule shall incorporate appropriate activities and WORK sequences based upon the Contract Documents.

2.02 CONSTRUCTION SCHEDULE SUBMITTAL:

- A. The Construction Schedule submittal, which refers to both the Baseline Schedule and all Schedule Updates, are to consist of the following items:

1. An electronic file containing PDF formats of all required reports and graphics, including a written narrative.
 2. An electronic backup of the Construction Schedule in in Microsoft Project format, or approved equal.
 3. For Schedule Updates, a copy of the payment application is required. The Period Ending date in the DISTRICT Application for Payment must match the Data Date of the corresponding Schedule Update.
- B. The Schedule Narrative Report for the Construction Schedule shall consist of a written description of how the WORK will be accomplished in accordance with the planned Construction Schedule. The Schedule Narrative accompanying each Schedule Update shall, at a minimum, compare current progress and cost performance to the accepted baseline schedule for all milestones and activities, including longest path activities. If there are potential or actual delays, the narrative shall state the cause of the delay and impact to the Construction Schedule and define steps that have been taken or intend to be taken to mitigate delay impacts. The CONTRACTOR shall list any proposed changes in network activities and logic that will need to be incorporated into a revision to the Baseline Schedule. The narrative shall provide sufficient detail to allow the DISTRICT to verify the progress of the WORK, compare actual versus planned activities, and identify assumptions made in scheduling work, including Change Order work. The CONTRACTOR shall direct specific attention, in writing, to adjustments or corrections made, either in response to the DISTRICT's comments on the previous submittal or otherwise. A Schedule Narrative Report must be provided for all Baseline Schedules and Schedule Updates even if there are no detailed comments for each sub-heading.
1. Schedule Narrative Report
 - a. The Schedule Narrative Report shall show the following sub-headings with detailed comments:
 - i. Progress, issues, delays, and claims
 - ii. Schedule changes, including out-of-sequence work
 - iii. Milestones
 - iv. Critical submittals and Procurement items
 - v. Response to DISTRICT Review comments from previous submittal on an item by item basis.
 - b. It shall be an electronic color PDF – 8 ½ x 11 portrait format file.

PART 3 - EXECUTION

3.01 MONTHLY UPDATE CYCLE:

- A. Schedule Update Submittals are due every 30 days and are to be attached to each Application for Payment. The Schedule Update Total Actual Cost to Date must match the Application for Payment WORK Completed and Stored to Date amount. The DISTRICT will advise the CONTRACTOR of any change to the due dates.

3.02 CHANGES:

- A. Within ten (10) days after a schedule problem is identified by either CONTRACTOR or DISTRICT the CONTRACTOR shall submit a Construction Recovery Schedule that identifies the cause of the Change and any actions required by the CONTRACTOR to recover the schedule and complete the WORK within Contract Time. The CONTRACTOR shall promptly undertake appropriate action, at no additional cost to the DISTRICT, to recover the schedule whenever the current schedule shows that the CONTRACTOR did not or cannot achieve a milestone established in the Contract.
- B. Appropriate recovery actions include, but are not limited to, assignment of additional labor, subcontractors, equipment, shift or overtime work, expediting of submittal or deliveries, or any combination of thereof. Overlapping of activities or sequencing changes shall be deemed appropriate only if properly substantiated in the submittal. Recovery plans that are accepted by the DISTRICT that add, delete, or change activities, activity relationships, and durations or constraints must be submitted

as a Revision to the Baseline Schedule with zero Total Float in accordance with this specification. Once the revised baseline is accepted by the DISTRICT, the CONTRACTOR must prepare a Schedule Update of the Baseline Schedule with all actuals to date and submit it for acceptance.

END OF SECTION

SECTION 01320 CONSTRUCTION VIDEO AND PHOTOGRAPHS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION specifies administrative and procedural requirements for construction photographs.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 SUBMITTALS:

- A. Submit photographs electronically as specified in SECTION 01300 and in PART 3, this SECTION.

1.03 QUALITY ASSURANCE:

- A. Photographs and video shall be clear and sufficient to show significant detail, not blurred, or taken in shadow, nor too distant. The DISTRICT may require that the photographs or video be retaken should the quality be insufficient. Costs for such re-takes are the CONTRACTOR's responsibility at no extra cost to the DISTRICT.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC REQUIREMENTS:

- A. Specified in PART 3, this SECTION.

PART 3 - EXECUTION

3.01 COLOR AUDIO VIDEO TAPING OF CONSTRUCTION AREA:

- A. Prior to beginning any construction, the CONTRACTOR shall prepare a digital color audio video recording of all the areas to be affected by construction.
- B. The audio video recording shall be done within the two-week period prior to placement of materials or equipment on the construction area and furnished one week prior to the start of construction. Contractor shall provide 48 hour notice prior to recording video.
- C. To preclude the possibility of tampering or editing in any manner, all video recordings shall, by electronic means, generate and display continuously and simultaneously on the screen digital information to include the date and time of recording. The time information shall consist of hours, minutes and seconds, separated by colons (i.e., 10:35:18).
- D. The audio video recording shall consist of one video and one audio track which shall be recorded simultaneously. All tracks shall consist of original live recordings and thus shall not be copies of other audio and video recordings. The audio track shall contain the narrative commentary.
- E. The rate of speed in the general direction of travel of the conveyance used during recording shall be controlled to provide a usable image. Panning rates and zoom-in, zoom-out rates shall be controlled sufficiently such that playback will produce clarity of the object viewed.
- F. All recording shall be done during times of good visibility. No recording shall be done during periods of visible precipitation, unless otherwise authorized by the DISTRICT.

- G. The DISTRICT shall have the authority to designate what areas may be omitted or added for audio video coverage.
- H. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be less than eight feet to insure perspective.
- I. In some instances, audio video coverage will be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking.
- J. Areas covered shall include offsite roadways that will be subjected to heavy usage such as for haul routes or delivery of heavy components or equipment. CONTRACTOR shall include all laydown areas, access roads, gates, fences, and project drainage boundaries.

3.02 PROGRESS SITE PHOTOGRAPHS:

- A. The CONTRACTOR shall be responsible for photographs of the Site to show the existing and general progress of the WORK. The DISTRICT will advise as to which views are of interest. Photographs shall be taken of the following areas and at the following times.
 - 1. Existing Site conditions before Site WORK is started. Number of views shall be adequate to cover the Site.
 - 2. Progress of the WORK from beginning and throughout construction. Progress photos must be provided with each pay request. Pay requests will not be considered acceptable until photographs are provided. Number of views shall be adequate to cover the Site.
 - 3. Finished Project after completion of WORK. Number of views shall be adequate to show the finished WORK.
 - 4. If Project is not completed during the Contract Time, or authorized extensions, photographs shall continue to be taken at no increase in Contract Price.
- B. Photographs shall be taken with five (5) megapixel minimum resolution.
- C. Provide a CD, DVD, or jump drive medium containing all photographic images in JPG format. Label CD with the name and Contract number of Project, name of CONTRACTOR, description of view, and date photograph was taken.
- D. Deliver digital media to DISTRICT with pay applications.

3.03 AERIAL PHOTOGRAPHS:

- A. Aerial photographs are not required for this project.

END OF SECTION

SECTION 01410 TESTING AND QUALITY CONTROL

PART 1 - GENERAL

1.01 CONTRACTOR QUALITY CONTROL: The CONTRACTOR shall provide and maintain an effective quality control program that fulfills the requirements of the Contract Documents.

- A. Establish a quality control system to perform sufficient inspection of all items of Work, including that of Subcontractors, to insure conformance to the Specifications and Drawings with respect to the materials, workmanship, construction, equipment performance, and identification.
- B. The CONTRACTOR's job supervisory staff may be used for quality control, supplemented as necessary by additional personnel for surveillance or special technicians to provide capability for the controls required by the Technical Specifications. The CONTRACTOR's quality control plan must clearly identify the quality control leader and personnel organizational system. The leader must have the authority to direct the removal and replacement of work.
- C. After the Contract is awarded and before construction begins, the CONTRACTOR shall meet with the DISTRICT or its representative to discuss quality control requirements. The meeting shall develop mutual understanding relative to details of the system, including the CONTRACTOR's forms to be used for recording the quality control operations, inspections, administration of the system, and the interrelationship of CONTRACTOR and DISTRICT inspection.
- D. All compliance inspections shall be recorded on appropriate forms, including but not limited to the specific items required in each section of the Technical Specifications. Those forms, including record of corrective actions taken, shall be furnished to the DISTRICT. The DISTRICT's quality control representative shall maintain a check off list of all deficiencies which are not corrected the same day as they are discovered.
- E. Should recurring deficiencies in an item or items indicate that the quality control system is not adequate, the CONTRACTOR shall take such corrective actions as may be required to comply with the Contract Documents.
- F. CONTRACTOR shall submit his written quality control plan for review, describing the activities and listing those inspection and testing activities that the CONTRACTOR will perform prior to beginning the Work. The CONTRACTOR's Quality Control Plan shall describe how he will communicate timely notification to allow for test and inspection activities performed by the DISTRICT, or its representatives, for on and off-site construction activities.

1.02 TESTING LABORATORY SERVICES: All tests which require the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing laboratory acceptable to DISTRICT. The laboratory shall be staffed with experienced technicians, properly equipped, ACI certified, and fully qualified to perform the tests in accordance with the specified standards.

1.03 TESTING LABORATORY SERVICES FURNISHED BY CONTRACTOR: All testing laboratory services in connection with tests (which are identified as the CONTRACTOR's responsibility in the Contract Documents) shall be performed and paid for by the CONTRACTOR, and a certified copy of the results will be furnished to the DISTRICT within 5 days of the test.

The CONTRACTOR is also responsible for testing and inspection services required to achieve an effective quality control program, to assure that the work strictly complies with the contract requirements. CONTRACTOR shall pay all costs for such services. CONTRACTOR shall also pay for any tests performed by DISTRICT which do not meet Specifications, as described below.

1.04 TESTING LABORATORY SERVICES FURNISHED BY DISTRICT:

- A. The DISTRICT may secure the services of a materials testing company, for field and laboratory tests, for certain items of work for quality assurance.
 - 1. DISTRICT shall be reimbursed by CONTRACTOR for the cost of any tests or inspections, or tests on an item purported to be ready, which fail to meet Specification requirements. DISTRICT may withhold such amounts from payments otherwise due CONTRACTOR.
- B. Arrangements for delivery of samples and test specimens to the testing laboratory under this paragraph will be made by the DISTRICT. The testing laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.
- C. CONTRACTOR shall furnish all sample materials and cooperate in the sampling and field testing activities, interrupting the Work when necessary.
- D. When sampling or testing activities are performed in the field by testing laboratory personnel, CONTRACTOR shall furnish personnel and facilities to assist in the activities.

1.05 TRANSMITTAL OF TEST REPORTS:

- A. Written reports of test and engineering data furnished by CONTRACTOR shall be submitted as specified in SECTION 01300.

END OF SECTION

SECTION 01510 TEMPORARY UTILITIES AND FACILITIES

PART 1 - GENERAL

1.01 SUMMARY:

- A. This SECTION includes requirements of a temporary nature not normally incorporated into final WORK. It includes the following:
 - 1. Utility services
 - 2. Construction and support facilities
 - 3. Construction aids
 - 4. Fire protection
 - 5. Bypass flow
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 01530 – Temporary Barriers and Controls
 - 3. SECTION 01590 - Field Offices and Sheds
 - 4. SECTION 02402 - Bypass

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American National Standards Association (ANSI):
 - a. A10 Series - Safety Requirements for Construction and Demolition
 - b. ANSI/ASME PTC 19.1-1998 Test Uncertainty, Instrument and Apparatus
 - 2. National Electrical Contractors Association (NECA):
 - a. Electrical Design Library - Temporary Electrical Facilities
 - 3. National Fire Protection Association (NFPA):
 - a. NFPA 10 - Portable Fire Extinguishers
 - b. NFPA 70 - National Electrical Code
 - c. NFPA 241 - Safeguarding Construction, Alterations, and Demolition Operations
 - 4. National Electrical Manufacturers Association (NEMA)
 - 5. Underwriters Laboratories (UL)
 - 6. Florida Department of Transportation Standard Specifications for Road and Bridge Construction
 - 7. Florida Trench Safety Act (90-96, Laws of Florida)

1.03 SUBMITTALS:

- A. Submit in accordance with SECTION 01300.

- B. Site Plan: Submit to the DISTRICT a Site Plan indicating CONTRACTOR's facilities including:
1. Trailers
 2. Equipment Yard
 3. Parking
 4. Traffic Control
 5. Bypass flow

1.04 QUALITY ASSURANCE:

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
1. Building Code requirements
 2. Utility company regulations
 3. Police, Fire Department, and rescue squad rules
 4. Environmental protection regulations
- B. Standards:
1. Comply with NFPA 10 and 241, and ANSI A10 Series standards "Temporary Electrical Facilities."
 2. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70.
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT:

- A. Provide new materials and equipment. If acceptable to the DISTRICT, undamaged previously used materials and equipment in serviceable condition may be used. Provide materials and equipment suitable for the use intended, of capacity for required usage, and meeting applicable codes and standards. Comply with requirements of DIVISIONS 2 through 16.
- B. Water: Provide potable water approved by local health authorities.
- C. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- D. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- E. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

- F. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- G. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- H. Bypass Flows System: The CONTRACTOR shall provide bypass flow system as specified in SECTION 02402.

PART 3 - EXECUTION

3.01 TEMPORARY UTILITIES:

- A. General:
 - 1. Engage the appropriate local utility company to extend temporary electric and phone service to the Project area from nearby existing utilities. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 2. Provide adequate utility capacity at each stage of construction. Prior to availability of temporary utilities at the Site, or in remote areas without services, provide trucked-in services as required for start-up and construction operations.
 - 3. Furnish, install and maintain temporary utilities required for adequate construction, safety and security. Modify, relocate and extend systems as WORK progresses. Repair damage caused by installation or use of temporary facilities. Grade the areas of Site affected by temporary installations to required elevations and grades, and clean the area. Remove on completion of WORK or until service or facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
 - 4. The types of temporary construction utilities and facilities required include, but are not limited to, potable drinking water, wastewater, drainage, dewatering equipment, enclosure of WORK, ventilation, electrical power, lighting, hoisting facilities, stairs, ladders, and roads.
 - 5. Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.
 - 6. Materials used for temporary service shall not be used in the permanent system unless so specified or acceptable to the DISTRICT.

3.02 TEMPORARY ELECTRICITY AND LIGHTING:

- A. New Service:
 - 1. Arrange with utility company to extend existing electric service to temporary office trailers.
 - 2. Connect temporary service in a manner directed by utility company officials. Provide separate meter for metering of power used by all entities authorized to be at or perform WORK at the Project Site.
 - 3. The electric service shall be of sufficient capacity and characteristics for the various construction tools, machinery, lights, heating and air conditioning, pumps, and other tools required by CONTRACTOR and his Subcontractors. In areas of the Project where permanent

or temporary power service from the local utility is not available, the CONTRACTOR shall supply and maintain engine-driven, power-generator sets.

4. Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating and lighting. Provide overload protection. Supply power for electric welding, if any, from engine-driven, power-generator sets.
 5. Provide adequate artificial lighting for all areas of WORK when natural light is not adequate for WORK.
 6. Sufficient light shall be provided for general construction areas, with additional sufficient lighting for specific tasks and to meet safety requirements.
- B. Use of Permanent System:
1. Prior to use of permanent system to be installed by the power company for construction purposes, obtain written permission of the DISTRICT.
 2. Maintain permanent system as specified for temporary facilities.
- C. Costs of Installation and Operation:
1. Pay fees and charges for permits and applications.
 2. Pay costs of installation, maintenance, removal of temporary services, and restoration of any permanent facilities used.
 3. Pay costs of electrical power used (if applicable).
 4. Pay costs of furnishing, operating, and maintaining engine-driven power-generator sets, where applicable.

3.03 TEMPORARY HEAT AND VENTILATION:

- A. General:
1. Provide temporary heat, ventilation and cooling as required to maintain adequate environmental conditions in temporary office trailers and storage sheds and to facilitate progress of the WORK, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage. Protect from adverse affects of low temperatures or high humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
 2. Methods of heating and fuel shall be suitable for particular purposes. Portable heaters shall be standard approved units with controls.
- B. Costs of Installation and Operation:
1. Pay fees and charges for applications, permits, and inspections.
 2. Pay costs of installation, operation, maintenance, removal of equipment, and restoration of existing or permanent facilities if used.
 3. Pay cost of power and fuel used.

3.04 TEMPORARY TELEPHONE SERVICE: NOT USED

3.05 TEMPORARY SANITARY FACILITIES:

- A. CONTRACTOR-Furnished Facilities:
1. Furnish, install and maintain temporary sanitary facilities for use through construction period. Remove on completion of WORK.

2. Provide for all construction workers under this Contract and representatives at the Site.
3. Toilet facilities shall be of the chemical-aerated recirculation or combustion type, properly vented and fully enclosed with a glass- fiber-reinforced polyester shell or similar nonabsorbent material.

3.06 TEMPORARY CONSTRUCTION AIDS:

A. General:

1. Provide construction aids and equipment required by personnel, available for DISTRICT observers' use, and to facilitate the execution of the WORK; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.
2. Materials may be new or used, must be suitable for the intended purpose and meet the requirements of applicable codes, regulations and standards.
3. When platform stair framing is in place, provide temporary treads, platforms, and railings for use by construction personnel.

3.07 TEMPORARY BYPASS FLOW:

- A. The CONTRACTOR shall furnish a bypass system as specified in specification SECTION 02402.

3.08 INSTALLATION AND REMOVAL:

- A. Relocation: Relocate construction aids as required by progress of construction, by storage or WORK requirements, and to accommodate requirements of DISTRICT and other CONTRACTORS at the Site.
- B. Removal: Remove temporary materials, equipment and services when construction needs can be met and allowed by use of permanent construction, or at completion of the Project.
- C. Repair: Clean and repair damage caused by installation or by use of temporary facilities.
1. Remove foundations and underground installations for construction aids.
 2. Grade the areas of the Site affected by temporary installations to required elevations and clean the area.

END OF SECTION

SECTION 01530 TEMPORARY BARRIERS AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes General Requirements for:
 - 1. Protection of Work
 - 2. Protection of existing property
 - 3. Barriers
 - 4. Security
 - 5. Environmental controls
 - 6. Access roads and parking areas
 - 7. Traffic control and use of roadways
- B. Related Work Specified Elsewhere:
 - 1. SECTION 02435 Turbidity Control and Monitoring

1.02 REFERENCES:

- A. Florida Department of Transportation Standard Specifications for Road and Bridge Construction (FDOT)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 SAFETY AND PROTECTION OF WORK AND PROPERTY:

- A. General:
 - 1. Provide for the protection of the Work as set forth in the Contract Documents. Provide protection at all times against rain, wind, storms, frost, freezing, condensation, or heat so as to maintain all Work and Equipment and Materials free from injury or damage. At the end of each day all new Work likely to be damaged shall be appropriately protected.
 - 2. Notify DISTRICT immediately at any time operations are stopped due to conditions which make it impossible to continue operations or to obtain proper results.
 - 3. Construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations, pits, and trenches dewatered sufficiently to permit continuous construction.
 - 4. Protect floors from damage by proper covering and care when handling heavy equipment, painting, or handling mortar or other such materials. Use proper cribbing and shoring to prevent overloading of floors while moving heavy equipment. Provide metal pans under pipe-threading machines and other machines that may leak oil and clean such pans daily, keeping oil off floors. Restore floors to former condition where damaged or stained.
 - 5. Concrete floors less than 28-days old shall not be loaded without written permission from DISTRICT.
 - 6. Restrict access to roofs except as required by the Work. Where access is required, provide protection with plywood, boards, or other suitable materials.

B. Property Other than DISTRICT's:

1. Provide for the protection of property as set forth in the Contract Documents. Report immediately to the owners thereof and promptly repair damage to existing facilities resulting from construction operations.
2. Names and telephone numbers of representatives of the power company having jurisdiction over power lines in the Work area can be obtained from the DISTRICT. CONTRACTOR shall contact the power company a minimum of 7 calendar days prior to performing Work within 500' of power transmission line property, right-of-way or easement lines.
3. The applicable requirements specified for protection of the Work shall also apply to the protection of existing property of others.
4. Restore all property affected by CONTRACTOR's operations to the original or better condition.

3.02 BARRIERS:

A. General:

1. Furnish, install, and maintain suitable barriers as required to prevent public entry, protect the public, and to protect the Work, existing facilities, trees, and plants from construction operations. Remove when no longer needed or at completion of Work.
2. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards or regulatory agencies.
3. Barriers shall be of a neat and reasonable uniform appearance, structurally adequate for the required purposes.
4. Maintain barriers in good repair and clean condition for adequate visibility.
5. Relocate barriers as required by progress of Work.
6. Repair damage caused by installation and restore area to original or better condition. Clean the area.

3.03 ENVIRONMENTAL CONTROLS:

A. Dust Control:

1. If appropriate to the site location, and at the discretion of the DISTRICT, provide positive methods and apply dust control materials to minimize raising dust from construction operations.
2. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
3. Schedule operations so that dust and other contaminants will not fall on wet or newly-coated surfaces.
4. Cover materials transported to and from site as necessary to prevent depositing material on offsite roadways or creating dust.

B. Water and Erosion Control:

1. Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties as specified in SECTION 02435. Coordinate with on-site farming operations.
2. Plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - a. Hold the areas of bare soil exposed at one time to a minimum.
 - b. Provide temporary control measures such as berms, dikes, and drains.

3. Control fill, grading, and ditching to direct surface drainage away from excavations and other construction areas, and to direct drainage to proper runoff.
 4. Provide, operate, and maintain hydraulic equipment of adequate capacity to control surface and ground water.
 5. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas.
- C. Debris Control and Clean-Up:
1. Keep the premises free at all times from accumulations of debris, waste materials, and rubbish caused by construction operations and employees. Responsibilities shall include:
 - a. Adequate trash receptacles about the site, emptied promptly when filled.
 - b. Periodic cleanup to avoid hazards or interference with operations at the site and to maintain the site in a reasonably neat condition.
 - c. The keeping of construction materials such as forms and scaffolding neatly stacked.
 - d. Immediate cleanup to protect the Work by removing splattered concrete, oil, paint, corrosive liquids, and cleaning solutions from walls, floors, and metal surfaces before surfaces are marred.
 2. Prohibit overloading of trucks to prevent spillages on access and haul routes. Provide periodic inspection of traffic areas to enforce requirements.
 3. Final cleanup is specified in SECTION 01700 Contract Closeout.
- D. Pollution Control:
1. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by the discharge of hazardous or toxic substances from construction operations.
 2. Provide equipment and personnel and perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off-site in approved locations, and replace with suitable compacted fill and topsoil.
 3. Take special measures to prevent harmful substances from entering public waters, sanitary, or storm sewers.
 4. If hazardous materials are discharged, report to authorities as required by Law or Regulations and notify DISTRICT.

3.04 TRAFFIC CONTROL AND USE OF ROADWAYS:

- A. Traffic Control:
1. Provide, operate, and maintain equipment, services, and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow on haul routes, at site entrances, on-site access roads, and parking areas. This includes barricades and other devices or personnel as necessary to adequately protect the public. Prepare and submit Traffic Control Plan to DISTRICT for acceptance.
 2. Remove temporary equipment and facilities when no longer required. Restore grounds to original, better, or specified conditions.
 3. Provide and maintain suitable detours or other temporary expedients if necessary.
 4. Bridge over open trenches where necessary to maintain traffic.
 5. Consult with governing authorities to establish public thoroughfares which will be used for site access. All operations shall meet the approval of owners or agencies having jurisdiction.

B. Maintenance of Roadways:

1. Repair off-site roads, water control and DISTRICT levees damaged by operations. Keep traffic areas as free as possible of excavated materials and maintain in a manner to eliminate dust, mud, and hazardous conditions.
2. All operations and repairs shall meet the approval of owners or agencies having jurisdiction.

3.05 SECURITY:

- A. The CONTRACTOR is solely responsible for initiating and maintaining security at the construction site. CONTRACTOR shall take all necessary precautions for the security of, and shall provide the necessary protection to:
1. Materials and equipment incorporated into the work, or stored on-site prior to incorporation into the work.
 2. Temporary field offices and sheds, and their contents including those listed in SECTION 01590.
 3. Plant and equipment including any equipment furnished for use by the DISTRICT.
- B. The CONTRACTOR shall replace, in kind, any materials or equipment lost, damaged or destroyed at its own expense.

END OF SECTION

SECTION 01580 PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes basic requirements for temporary Project identification and informational signs required during construction.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 1300 Submittals.

1.02 QUALITY ASSURANCE:

- A. Design sign and structure to withstand wind and environmental conditions of locality. Provide with finish adequate to withstand weathering, fading, chipping, and peeling for duration of construction.

1.03 SUBMITTALS:

- A. Submit as specified in SECTION 01300.
- B. Includes, but not limited to, the following:
 - 1. Shop Drawings and product data as applicable.
 - 2. Show content, layout, lettering, colors, structure, and foundation.

PART 2 - PRODUCTS

2.01 IDENTIFICATION SIGNS:

- A. Project Identification:
 - 1. Construct structure and framing of wood or metal, structurally adequate to resist design requirements of locality.
 - 2. Construct sign surface of minimum 3/4-inch thickness exterior grade plywood with medium density overlay. Panels shall be of size to minimize joints. Overall size shall be 48 inches by 96 inches.
 - 3. Rough hardware shall be galvanized or aluminum.
 - 4. Coating: Paint shall suitable for outdoor applications and shall be resistant to weathering, peeling, chipping and fading. Sign colors shall be approved by the DISTRICT.
 - 5. Information Content:
 - a. Project title, logo, and name of DISTRICT as shown on Contract Documents
 - b. Names and titles of authorities
 - c. Name and title of Design Engineer
 - d. Name of prime CONTRACTOR and major Subcontractors
- B. CONTRACTOR Identification: If not part of Project identification sign, provide and install CONTRACTOR's standard sign.
- C. Design Engineer Identification: Design Engineer will provide, install and maintain his own signs.

2.02 INFORMATIONAL SIGNS:

A. Construction:

1. This includes signs for traffic, construction workers, and general public in regards to directions, warnings, hazards, locations of areas, facilities, equipment, and others of a similar nature.
2. Provide signs of design, size, color, and lettering as required by regulatory agencies. Signs shall be painted metal, wood, plastic, or fiberglass and of materials suitable for the conditions in which it is placed, such as weathering and fading.
3. Construct structure and framing of wood or metal, structurally adequate to resist design requirements of area of Project.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Project and Contractor Identification Sign:

1. Install in a location acceptable to the DISTRICT. Install so as not to obstruct traffic or construction operations.
2. Erect on framing or foundation, and rigidly brace.
3. Maintain sign in good repair, in a clean and neat condition.
4. Remove upon completion of Project.

B. Informational Signs:

1. Install at appropriate locations and in sufficient quantities to assure visibility. Relocate as required by progress of Work.
2. Maintain signs in good repair, in a neat, clean, readable condition.
3. Remove all signs, framing, supports, and foundations upon completion of Project.

END OF SECTION

SECTION 01590 FIELD OFFICES AND SHEDS

PART 1 - GENERAL

1.01 SUMMARY: This section includes requirements for temporary field offices and other structures for office and storage space required by CONTRACTOR and the DISTRICT.

- A. Related Work:
 - 1. SECTION 01600 Equipment and Materials
 - 2. SECTION 01510 Temporary Utilities and Facilities
- B. Use of Existing Facilities: Existing facilities at the site shall not be used for field offices.
- C. Use of Permanent Facilities: Permanent facilities when substantially completed shall not be used for field offices or for storage.

PART 2 - PRODUCTS

2.01 FIELD OFFICES:

- A. General:
 - 1. Provide trailers, mobile buildings, or buildings constructed with floors raised aboveground, with steps and landings at entrance doors.
 - 2. Buildings shall be structurally sound, secure, and weathertight.
 - 3. Provide four appropriate type fire extinguishers at each office and storage area.
 - 4. Obtain any required building permits for installation of temporary field offices and sheds.
- B. CONTRACTOR's Office:
 - 1. Provide a field office for CONTRACTOR's superintendent on the site.
 - 2. It shall be of size required for general use, with lights, heat, furnishings, telephone service, and other necessary facilities and utilities required by CONTRACTOR's operations.

2.02 STORAGE SHEDS AND TRAILERS:

- A. On-Site:
 - 1. The CONTRACTOR shall be solely responsible for its own temporary buildings and trailers located on site.
- B. Off-Site:
 - 1. The CONTRACTOR shall advise the DISTRICT of any arrangements made for storage of Equipment and Materials in a place other than DISTRICT's site. Furnish evidence of insurance coverage with Application for Payment in conformance with the General Terms & Conditions.

PART 3 - EXECUTION

3.01 LOCATION, INSTALLATION AND MAINTENANCE:

- A. General:
 - 1. Place temporary buildings, trailers and stored materials in locations acceptable to DISTRICT.

2. Installed field offices and sheds to resist winds and elements of the locality where installed.
3. Remove when no longer needed at the site or when Work is completed.
4. Keep approach walks free of leaves, mud, water, or ice.
5. At completion of Work, remove temporary buildings and trailers, foundations (if any), utility services, and debris.
6. Prepare ground or paved areas as specified in applicable Sections.

END OF SECTION

SECTION 01600 EQUIPMENT AND MATERIALS

PART 1 - GENERAL

1.01 SUMMARY: This section includes general requirements for Equipment and Material transportation and handling, delivery, storage, and protection of CONTRACTOR and DISTRICT - furnished Equipment and Materials.

A. Related Work:

1. SECTION 01630 Product Options and Substitutions
2. SECTION 01300 Submittals

1.02 DEFINITIONS: Definitions used in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including such terms as "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.

- A. Products: Items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the Project or taken from the previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and other terms of similar intent.
- B. Equipment: A product with operational or non-operational parts, regardless of whether motorized, manually operated, or fixed. Equipment may require service connections such as wiring or piping.
- C. Materials: Products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form parts of Work.

1.03 QUALITY ASSURANCE:

- A. Equipment and Material Incorporated into the Work: Provide products that comply with the requirements of the Contract Documents, are undamaged, and unless otherwise indicated, are unused at the time of installation. The CONTRACTOR shall provide products that are complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.
- B. Standard Products: Where they are available and comply with Specifications, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- C. Continued Availability: Where, because of the nature of its application, the DISTRICT is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard products for which the manufacturer has published assurances that the products and its parts are likely to be available to the DISTRICT at a later date.
 1. Conform to applicable Specifications, codes, standards, and regulatory agencies.
 2. Comply with size, make, type, and quality specified, or as specifically approved in writing by the DISTRICT.
 3. Manufactured and Fabricated Products:
 - a. Design, fabricate, and assemble in accordance with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Equipment and Materials shall be suitable for service conditions intended.

- d. Equipment capacities, sizes, and dimensions indicated or specified shall be adhered to unless variations are specifically approved in writing.
 - e. Provide labels and nameplates where required by regulatory agencies or to state identification and essential operating data.
 - f. Two or more items of the same kind shall be identical, supplied by the same manufacturer.
4. Do not use equipment and material for any purpose other than that for which it is designed or is specified.
- D. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- E. Identification: Each item of equipment shall have permanently affixed to it a label or tag with its equipment number designated in this contract. Marker shall be stainless steel and shall be located so as to be easily visible.

1.04 TRANSPORTATION AND SHIPMENT:

- A. Shipment Preparation: CONTRACTOR shall require manufacturers and suppliers to prepare Equipment and Materials for shipment in a manner to facilitate unloading and handling, and to protect against damage or unnecessary exposure in transit and storage, for CONTRACTOR supplied equipment. Provisions for protection shall include the following:
- 1. Crates or other suitable packaging materials
 - 2. Covers and other means to prevent corrosion, moisture damage, mechanical injury, and accumulation of dirt in motors, electrical equipment, and machinery
 - 3. Suitable rust-preventive compound on exposed machined surfaces and unpainted iron and steel
 - 4. Grease packing or oil lubrication in all bearings and similar items
 - 5. Precast concrete components shall be transported, lifted and stored as specified by the precast supplier. Precast supplier shall provide written instructions to the CONTRACTOR as to the above. CONTRACTOR shall provide a copy to DISTRICT.
- B. Marking: Each item of Equipment and Material shall be tagged or marked as identified in the delivery schedule or on Submittals. Complete packing lists and bills of material shall be included with each shipment. Each piece of every item need not be marked separately, provided that all pieces of each item are packed or bundled together and the packages or bundles are properly tagged or marked.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Delivery – The CONTRACTOR shall:
- 1. Arrange deliveries of Equipment and Materials in accordance with construction schedules, in ample time to facilitate inspection prior to installation, and to avoid delay of the Work.
 - 2. Deliver, store and handle Equipment and Materials in accordance with manufacturer's recommendations using means and methods that will prevent damage, deterioration, and loss, including theft.
 - 3. Control delivery schedules to minimize long term storage at the site and to prevent overcrowding of construction spaces. In particular, coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.
 - 4. Avoid conflict with Work of DISTRICT or other contractors.

5. Deliver Equipment and Materials to the site in manufacturer's sealed containers or other packaging system with identifying labels and instructions for handling, storing, unpacking, protecting, and installing.
 6. Mark deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts, and to facilitate inspection and measurement of quantity or counting of units.
 7. Immediately on delivery, inspect shipment to assure:
 - a. Product complies with requirements of Contract Documents and reviewed Submittals.
 - b. Quantities are correct.
 - c. Containers and packages are intact, labels are legible.
 - d. Equipment and Materials are properly protected and undamaged.
- B. Storage – The CONTRACTOR shall:
1. Store Equipment and Materials immediately on delivery, and protect until completion of the Work. Store in accordance with manufacturer's instructions with seals and labels intact and legible.
 2. Store Equipment and Materials in a manner that will not endanger the supporting construction.
 3. Store Equipment and Materials that are subject to damage by elements in weathertight enclosures.
 4. Maintain temperature and humidity within ranges required by manufacturer.
 5. Protect motors, electrical equipment, plumbing fixtures, and machinery of all kinds against corrosion, moisture deteriorations, mechanical injury, and accumulation of dirt or other foreign matter.
 6. Protect exposed-machined surfaces and unpainted iron and steel as necessary with suitable rust-preventive compounds.
 7. Protect bearings and similar items with grease packing or oil lubrication.
 8. Handle and store steel plate, sheet metal, and similar items in a manner to prevent deformation.
 9. Exterior Storage:
 - a. Provide substantial platforms, blocking, or skids to support fabricated products aboveground; and to prevent soiling or staining. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
 - b. Store loose granular materials on solid surface areas to prevent mixing with foreign matter.
 - c. Provide surface drainage to prevent flow or ponding of rainwater.
 10. Equipment and Materials shall not show any pitting, rust, decay, or other deleterious effects of storage prior to final acceptance of Work.
 11. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
- C. Handling – The CONTRACTOR shall:
1. Provide equipment and personnel necessary, to unload and handle Equipment and Materials, by methods to prevent damage or soiling to Equipment and Materials, or packaging.

2. Handle by methods to prevent bending or overstressing. Where lifting points are designated, lift components only at those points.
 3. Provide additional protection to surrounding surfaces as necessary to prevent damage.
- D. Maintenance of Storage – The CONTRACTOR shall:
1. Inspect stored Equipment and Materials on a scheduled basis.
 2. Verify that storage facilities comply with manufacturer's product storage requirements, including environmental conditions continually maintained.
 3. Verify that surfaces of products exposed to elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.
 4. For mechanical and electrical equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions on exterior of package. Service Equipment on a regularly scheduled basis.
- E. Protection after installation – The CONTRACTOR shall: Provide substantial coverings as necessary to protect installed Equipment and Materials from damage from subsequent construction operations. Remove when no longer needed or as specified.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS:

- A. Specified in each applicable Section of Specifications

2.02 PRODUCT SELECTION AND SUBSTITUTIONS:

- A. Specified in Instructions to Bidders and General Terms & Conditions

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS:

- A. Installation:
1. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions if not a part of Submittals, containers, or packaging to parties involved in the installation, including a copy to the DISTRICT.
 2. Maintain one complete set of instructions at the job site during installation and until completion.
 3. Handle, install, connect, clean, condition, and adjust products in accordance with such instructions and in conformance with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with DISTRICT for further instructions.
 4. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents, or approved in writing by manufacturer and the DISTRICT.
 5. Accurately locate and align with other Work, and anchor Equipment and Materials securely in place except as required for proper movement and performance.
 6. Clean and protect exposed surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

END OF SECTION

SECTION 01630 PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 SUMMARY: This SECTION covers the DISTRICT's review procedures for CONTRACTOR's requests of acceptable substitute items of material and equipment. All requests for substitution shall be made no earlier than the Effective Date of the Contract.

Requests received prior to the date established above will not be considered. Substitutions may be approved at the DISTRICT's sole discretion where one or more of the following conditions apply:

- A. The substitution must be required for compliance with final interpretation of code requirements or regulations.
- B. The substitution must be due to the unavailability of the specified products, through no fault of the CONTRACTOR.
- C. The substitution may be requested when subsequent information discloses the inability of the specified products to perform properly or to fit in the designated space.
- D. The substitution may be requested when in the judgment of the DISTRICT a substitution would be substantially to the DISTRICT's best interests in terms of cost, time or other considerations.

1.02 SUBSTITUTION REQUEST:

- A. Submit as required in SECTION 01300 - Submittals:
 - 1. Complete data substantiating compliance of the proposed substitution with the Contract Document
 - a. Product identification including MANUFACTURER's name and address
 - b. MANUFACTURER's literature including product description, performance and test data, and reference standards
 - c. Name and address of similar projects on which product was used and dates of installation
 - 2. Itemized comparison of proposed substitution with product or method specified
 - 3. Data relating to changes in the construction schedule
 - 4. Accurate cost data on proposed substitution in comparison with product or method specified
- B. In submitting the request for substitution, the CONTRACTOR makes the following representations:
 - 1. The CONTRACTOR has investigated the proposed product and has determined that it is equal or superior in all respects to that specified.
 - 2. The CONTRACTOR will provide the same warranty or guarantee for the substitution as for the product specified.
 - 3. The CONTRACTOR will coordinate installation of the accepted substitution into the WORK, making such changes as may be required for the WORK to be completed in all respects.
 - 4. The CONTRACTOR waives all claims for additional costs related to substitution that subsequently becomes apparent.
 - 5. Cost data is complete and includes all related costs under the Contract.

1.03 DISTRICT ENGINEER'S REVIEW: The DISTRICT, in evaluating the request for substitution, will consider all variations of the proposed substitute from that specified to determine the acceptability of the proposal. The DISTRICT may require the CONTRACTOR to furnish additional data about the proposed substitute necessary to make such a determination. The DISTRICT will be the sole judge of acceptability, and no substitute will be ordered or installed without the DISTRICT's prior written acceptance. The DISTRICT may require the CONTRACTOR to furnish, at the CONTRACTOR's expense, a special performance guarantee or other surety with respect to any substitute. Substitutions will not be considered if:

- A. Substitutions are indicated or implied on Shop Drawings or product data submittals without a request submitted in accordance with this SECTION.

B. Acceptance will require substantial revision to the Contract Documents.

END OF SECTION

SECTION 01640 START UP/CHECK OUT/MANUFACTURER'S FIELD SERVICES FOR CONTRACTOR
FURNISHED EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY: This Section includes requirements of manufacturers for services to be performed at the Project site in regards to erection, start-up, and testing of equipment.

A. Related work specified elsewhere:

1. SECTION 01660 Equipment and System Performance and Operational Testing
2. SECTION 01662 Commissioning

1.02 SERVICES REQUIRED:

A. Services with Equipment and Materials Furnished Under this Contract:

1. Furnish the services of qualified field personnel from the manufacturers or suppliers of Equipment and Materials furnished and installed under this Contract, as required to perform all Manufacturer's Field Services called for in the Specifications. Field personnel shall be certified by the manufacturer of the specific product or system as having the necessary knowledge and experience to perform the required functions.
2. Where such service is specified, CONTRACTOR shall not perform any Work related to the installation or operation of Equipment and Materials furnished and installed under this Contract without direct observation and guidance of the manufacturer's or Supplier's field personnel unless DISTRICT concurs otherwise.
3. Where required, the Manufacturer's or Supplier's field personnel shall perform the following:
 - a. Observe the erection, installation, start-up and testing of equipment.
 - b. Instruct and guide CONTRACTOR in proper procedures.
 - c. Supervise the initial start-up, operational check, and any required adjustments of equipment.
 - d. Instruct DISTRICT's designated personnel in proper operation and maintenance of all equipment.
 - e. Furnish a written report to DISTRICT covering all Work done at least once each week and when Work on each item of equipment or system is completed.
4. CONTRACTOR shall provide five (5) day's notice prior to the arrival of any manufacturer's and supplier's field personnel at the site.

B. CONTRACTOR shall submit a start up/check out plan to the DISTRICT for review. Plan as a minimum will include components to be started/checked out, duration, personnel required, and details of procedures to be used.

PART 2 - PRODUCTS (Specified in applicable Sections)

PART 3 - EXECUTION

3.01 OPERATION AND TESTING:

A. Placing Equipment in Operation:

1. Place all Equipment and Materials installed under this Contract into successful operation according to instructions of the Supplier, manufacturer, or field representative, including making all required adjustments, tests, operation checks, and the following:
 - a. Cleaning, sounding, blowing-out, and flushing of lubricating oil and water systems, and other pipelines
 - b. Lubrication, fuels, supplies, power, consumables, water, and labor to be supplied by the Contractor for the duration of start up and testing, and until substantial completion of the work
 - c. Tests of lubrication system safety interlocks and system performance
 - d. Final alignment checks and measurements made under observation of the DISTRICT. Alignment checks shall include opening connections, if required, to ensure there are no abnormal stresses on equipment from pipes, ducts, or other attachments. Alignment shall be within tolerances specified by the manufacturer, and measurements shall be recorded and furnished to the DISTRICT.
 - e. Motor rotation checks before connecting couplings
 - f. Inspection of sleeve bearings for adequate contact
 - g. Checking of anchor-bolt tensions, grout and shims. Tighten anchor bolts with calibrated torque wrenches using care not to over stress bolts.
 2. After "run-in" and acceptance of alignment, and where specified, affix major equipment in place using standard tapered dowels with jack-out nuts at head end to facilitate removal.
 3. Record all above operations on forms acceptable to the DISTRICT.
 4. Furnish all necessary attendants and personnel as part of the Work to accomplish the above operations until such time as individual items, systems, equipment, or sections of the plant are acceptable for operation by DISTRICT.
 5. Provide attendants on a continuous basis as required to complete events without interruption once they have been started.
 6. CONTRACTOR shall provide lubricants for placing equipment in operation.
- B. Performance Tests:
1. Equipment and Materials Furnished Under this Contract:
 - a. DISTRICT may conduct acceptance tests after installation to determine if the Equipment and Materials installed as part of the Work perform in accordance with Contract Documents. Final acceptance of Equipment and Materials will be based on acceptable results of such tests.
 - b. No tests will be conducted on Equipment and Materials for which Manufacturer's Field Service is specified unless manufacturer's Field Representative is present and declares in writing that the Equipment and Materials are ready for such test.
 - c. The tests will be made as set forth in the Contract Documents unless the interested parties mutually agree upon some other manner of testing.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section contains requirements for the CONTRACTOR in documenting testing work required under this contract. In addition, this section contains requirements for the CONTRACTOR during installed performance testing of all mechanical, electrical, instrumentation, and HVAC equipment and systems, including structures for watertight construction, provided under this contract and all equipment furnished by the DISTRICT. This section supplements but does not supersede specific testing requirements found elsewhere in this project manual.

1.02 QUALITY ASSURANCE:

- A. CONTRACTOR's Quality Assurance Manager: The CONTRACTOR shall appoint an operations engineer or equally qualified operations specialist as Quality Assurance Manager to manage, coordinate, and supervise the CONTRACTOR's quality assurance program. The Quality Assurance Manager shall have at least 5 years of total experience, or experience on at least 5 separate projects, in managing the start-up commissioning of mechanical, electrical, instrumentation, HVAC, and piping systems. Operations Engineers shall be a graduate from a 4-year course in mechanical or civil engineering. Operations specialists shall have equivalent experience in the operation and maintenance of diesel engines, right-angle gear reducers, large drainage pumps, and standby engine generators. The quality assurance program shall include:

1. A testing plan setting forth the sequence in which all testing work required under this project manual will be implemented
2. A documentation program to record the results of all equipment and system tests
3. An installed performance testing program for all mechanical, electrical, instrumentation, and HVAC equipment and systems installed under this contract
4. A calibration program for all instruments, meters, monitors, gages, and thermometers installed under this contract
5. A calibration program for all instruments, gages, meters, and thermometers used for determining the performance of equipment and systems installed under this contract
6. A testing schedule conforming to the requirements specified in paragraph 01660-2.02 C

For the purposes of this Section, a system shall include all items of equipment, devices and appurtenances connected in such a fashion as their operation or function complements, protects or controls the operation or function of the others. The CONTRACTOR's Quality Assurance Manager shall coordinate the activities of all subcontractors and suppliers for equipment and materials supplied by both the CONTRACTOR and the DISTRICT to implement the requirements of this section.

1.03 CALIBRATION:

1. All test equipment (gages, meters, thermometers, analysis instruments, and other equipment) used for calibrating or verifying the performance of equipment installed under this contract shall be calibrated to within plus or minus 2 percent of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale. Pressure gages shall be calibrated in accordance with ANSI/ASME B40.1. Thermometers shall be calibrated in accordance with ASTM E77 and shall be furnished with a certified calibration curve.

2. Liquid flow meters, including all open channel flow meters and all meters installed in pipelines with diameters greater than 2 inches shall be calibrated in situ using either the total count or dye dilution methods. Gas flow meters installed in piping systems with diameters greater than 6 inches shall be calibrated in situ using the pitot tube velocity averaging method. Flow meter calibration work shall be performed by individuals skilled in the techniques to be employed. Calibration tests for flow metering systems shall be performed over a range of not less than 10 percent to at least 75 percent of system full scale. At least five confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by not less than three test runs with results which agree within plus or minus 2 percent.
- B. References: This section contains references to the following documents. They are a part of this section as specified and modified. In case of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

| <u>Reference</u> | <u>Title</u> |
|------------------------------------|--|
| ANSI/ASME B40.1-85 | Gauges Pressure Indicating Dial Type--Elastic Element |
| ASTM E77-84 | Method for Verification and Calibration of Liquid-in-Glass Thermometers |
| ASHRAE 41.8 | Standard Methods of Measurement of Flow of Gas |
| Dye Dilution Calibration Method | <u>Flow Measurement in Open Channels and Closed Conduits</u> Vol. 1, U.S. Department of Commerce, National Bureau of Standards, pg. 36; <u>Techniques of Water-Resources Investigations of the United States Geological Survey</u> , Chapter 16, Measurement of Discharge Using Tracers |

1.04 SUBMITTALS:

- A. Submittal material, to be submitted in accordance with SECTION 01300, shall consist of the following:
1. The CONTRACTOR's plan for documenting the results from the test program in conformance with the requirements of paragraph 01660-2.02 A, provided 8 weeks before testing is to begin, including:
 - a. Proposed plan for documenting the calibration of all test instruments
 - b. Proposed plan for calibration of all instrument systems, including flow meters and all temperature, pressure, weight, and analysis systems
 - c. Sample forms for documenting the results of field pressure and performance tests
 2. The credentials and certification of the testing laboratory proposed by the CONTRACTOR for calibration of all test equipment
 3. Preoperational check-out procedures, reviewed and approved by the respective equipment manufacturers
 4. Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by the CONTRACTOR for the systematic testing of all equipment and systems installed under this contract
 5. A schedule and subsequent updates, whenever schedule changes occur, presenting the CONTRACTOR's plan for testing the equipment and systems installed under this contract
 6. A schedule establishing the expected time period (calendar dates) when the CONTRACTOR plans to commence operational testing of the completed systems, along with a description of the temporary systems and installations planned to allow operational testing to take place

7. A summary of the Quality Assurance Manager's qualifications, showing conformance to paragraph 01660-1.02 A requirements

PART 2 - PRODUCTS

2.01 GENERAL:

- A. The CONTRACTOR shall prepare test plans and documentation plans as specified in the following paragraphs. The DISTRICT will not witness any test work for the purpose of acceptance until all test documentation and calibration plans and the specified system or equipment test plans have been submitted and accepted.

2.02 DOCUMENTATION:

- A. Documentation Plans: The CONTRACTOR shall develop a records keeping system to document compliance with the requirements of this Section. Calibration documentation shall include identification (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.

Equipment and system documentation shall include date of test, equipment number or system name, nature of test, test objectives, test results, test instruments employed for the test and signature spaces for the DISTRICT's witness and the CONTRACTOR's Quality Assurance Manager. A separate file shall be established for each system and item of equipment. These files shall include the following information as a minimum:

1. Metallurgical tests
2. Factory performance tests
3. Accelerometer recordings made during shipment
4. Field calibration tests
5. Field pressure tests
6. Field performance tests
7. Field operational tests

The CONTRACTOR shall develop test documentation forms specific to each item of equipment and system installed under this contract. Acceptable documentation forms for all systems and items of equipment shall be produced for review by the DISTRICT.

- B. Test Plans: The CONTRACTOR shall develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this contract. Each test plan shall be specific to the item of equipment or system to be tested. Test plans shall identify by specific equipment or tag number each device or control station to be manipulated or observed during the test procedure and the specific results to be observed or obtained. Test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, subcontractors' and manufacturers' representatives to be present and expected test duration.

As a minimum, the test plans shall include the following features:

1. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device
2. Calibration of all analysis instruments and control sensors
3. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the operating conditions described in the project manual.

4. System tests designed to duplicate, as closely as possible, operating conditions described in the project manual

Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.

The importance of the test plan submittals is represented by the requirement to provide it as a milestone on the construction progress schedule, and as a line item in the Schedule of Values. Delivery of all test plans required for the systematic field performance and operational tests for all equipment and systems installed under this contract shall be made eight weeks in advance of the date the CONTRACTOR wishes to begin such testing. Once the DISTRICT has reviewed and taken no exception to the CONTRACTOR's test plans, the CONTRACTOR shall reproduce the plans in sufficient number for the CONTRACTOR's purposes and an additional ten copies for delivery to the DISTRICT. No test work shall begin until the CONTRACTOR has delivered the specified number of final test plans to the DISTRICT.

- C. Testing Schedule: The CONTRACTOR shall produce a testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be in bar chart form, plotted against calendar time, shall detail the equipment and systems to be tested, and shall be coordinated with the CONTRACTOR's construction schedule specified in SECTION 01310. The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be submitted no later than four weeks in advance of the date testing is to begin. The DISTRICT will not witness any testing work for the purpose of acceptance until the CONTRACTOR has submitted a schedule to which the DISTRICT takes no exception. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily and meeting the requirements of this project manual.

2.03 SYSTEM AND EQUIPMENT PERFORMANCE TESTS:

- A. Each item of mechanical, electrical, instrumentation, and HVAC equipment installed under this contract shall be tested to demonstrate compliance with the performance requirements of this project manual.
- B. Each electrical, instrumentation, mechanical, piping, and HVAC system installed or modified under this contract shall be tested in accordance with the requirements of this project manual.

2.04 OPERATIONAL TESTS:

- A. Once all equipment and systems have been tested individually, the CONTRACTOR shall fill all systems with the intended process fluids sufficient to satisfy all individual component and system tests. The CONTRACTOR shall then operate all systems for a continuous period of not less than 5 days (with exception of the 950 cfs pumps, see below), simulating actual operating conditions to the greatest extent possible. The CONTRACTOR shall install temporary connections, bulkheads and make other provisions to recirculate process fluids or otherwise simulate anticipated operating conditions. During the operational testing period, the CONTRACTOR's Quality Assurance Manager and testing team shall monitor the characteristics of each machine and system and report any unusual conditions to the DISTRICT.
- B. A testing plan for the **[insert flow rate]** cfs pumps shall be provided for approval by the DISTRICT. It must verify that the system can be operated for extended periods to the anticipated performance.

2.05 PRODUCT DATA:

- A. Records produced during the testing program shall be considered as Product Data, to be provided in accordance with SECTION 01300.

PART 3 - EXECUTION

3.01 GENERAL:

- A. The CONTRACTOR's Quality Assurance Manager shall organize teams made up of qualified representatives of equipment suppliers (for both CONTRACTOR and DISTRICT supplied equipment and materials), subcontractors, the CONTRACTOR's independent testing laboratory, and others, as appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this contract. The objective of the testing program shall be to demonstrate, to the DISTRICT's complete satisfaction, that the structures, systems, and equipment constructed and installed under this contract meet all performance requirements and the facility is ready for the commissioning process to commence. In addition, the testing program shall produce baseline operating conditions for the DISTRICT to use in a preventive maintenance program.

3.02 CALIBRATION OF FIXED INSTRUMENTS:

- A. Calibration of analysis instruments, sensors, gages, and meters installed under this contract shall proceed on a system-by-system basis. No equipment or system performance acceptance tests shall be performed until instruments, gages, and meters to be installed in that particular system have been calibrated and the calibration work has been witnessed by the DISTRICT.
- B. All analysis instruments, sensors, gages, and meters used for performance testing shall be subject to recalibration to confirm accuracy after completion, but prior to acceptance of each performance test. All analysis instruments, sensors, gages, and meters installed under this contract shall be subject to recalibration as a condition precedent to commissioning under the provisions of SECTION 01662.

3.03 PERFORMANCE TESTS:

- A. General: Performance tests shall consist of the following:
 - 1. Pressure and/or leakage tests
 - 2. Electrical testing as specified in DIVISION 16
 - 3. Wiring and piping, individual component, loop, loop commissioning and tuning testing as described in DIVISION 13 and 16
 - 4. Preoperational checkout for all mechanical and HVAC equipment. Preoperational check-out procedures shall be reviewed and approved by the respective equipment manufacturers.
 - 5. Initial operation tests of all mechanical, electrical, HVAC, and instrumentation equipment and systems to demonstrate compliance with the performance requirements of this project manual

In general, performance tests for any individual system shall be performed in the order listed above. The order may be altered only on the specific written authorization of the DISTRICT after receipt of a written request, complete with justification of the need for the change in sequence.

- B. Pressure and Leakage Tests: Pressure and leakage tests shall be conducted in accordance with applicable portions of the Specifications. All acceptance tests shall be witnessed by the DISTRICT. Evidence of successful completion of the pressure and leakage tests shall be the DISTRICT representative's signature on the test forms prepared by the CONTRACTOR.
- C. Functional Checkout: Prior to energization (in the case of electrical systems and equipment), all circuits shall be run out and tested for continuity and shielding in accordance with the procedures required in DIVISION 16.
- D. Component Calibration and Loop Testing: Prior to energization (in the case of instrumentation system and equipment), all loops and associated instruments shall be calibrated and tested in accordance with the procedures required in DIVISIONS 13 and 16.

- E. Electrical Resistance: Electrical resistance testing shall be in accordance with DIVISION 16.
- F. Pre-Operational Tests: Preoperational tests shall include the following:
 - 1. Alignment of equipment using reverse dial indicator method
 - 2. Pre-operation lubrication
 - 3. Tests per the manufacturers' recommendations for prestart preparation and pre-operational check-out procedures

G. Functional Tests:

- 1. General: Once all affected equipment has been subjected to the required preoperational check-out procedures and the DISTRICT has witnessed and has not found deficiencies in that portion of the work, individual items of equipment and systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these specifications. If available, canal water may be employed for the testing of all liquid systems except gaseous, oil, or chemical systems. If not available, potable water shall be employed as the test medium. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including noise, temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the CONTRACTOR shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system at no additional cost to the DISTRICT. Disposal methods for test media shall be subject to review by the DISTRICT. During the functional test period, the CONTRACTOR shall obtain baseline operating data on all equipment with motors greater than 1 horsepower to include amperage, bearing temperatures, and vibration. The baseline data shall be collected for the DISTRICT to enter in a preventive maintenance system.

Test results shall be within the tolerances set forth in the detailed specification sections of this project manual. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory functional test, any doubt, dispute, or difference should arise between the DISTRICT and the CONTRACTOR regarding the test results or the methods or equipment used in the performance of such test, the DISTRICT may order the test to be repeated.

If the repeat test, using such modified methods or equipment as the DISTRICT may require, confirms the previous test, then all costs in connection with the repeat test will be paid by the DISTRICT. Otherwise, the costs shall be borne by the CONTRACTOR. Where the results of any functional test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by the CONTRACTOR at his expense. The CONTRACTOR shall provide, at no expense to the DISTRICT, all power, fuel, compressed air supplies, water, chemicals, and any other necessary consumable item, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work, required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.

- 2. Retesting: If under test, any portion of the work should fail to fulfill the contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall, unless otherwise directed by the DISTRICT, be repeated within reasonable time and in accordance with the specified conditions. The CONTRACTOR shall pay to the DISTRICT all reasonable expenses incurred by the DISTRICT, including the costs of the Engineer if applicable, as a result of repeating such tests.

3. Post-Test Inspection: Once functional testing has been completed, all machines shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the DISTRICT. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Any defects found during the course of the inspection shall be repaired or the specific part or entire equipment item shall be replaced to the complete satisfaction of the DISTRICT at no cost to the DISTRICT.

END OF SECTION

SECTION 01662 COMMISSIONING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION contains requirements for the CONTRACTOR's performance prior to (i.e. operational testing period) and during the commissioning of the structures, equipment and systems constructed and installed during the course of this Contract. All WORK during the operational testing period and prior to commissioning shall be done by the CONTRACTOR.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 QUALITY ASSURANCE:

- A. Cleanup: Following completion of the operational testing period, the CONTRACTOR shall remove, clean, and replace all permanent and temporary filters and strainers in all pipeline systems; replace all HVAC (heating, ventilation and air conditioning) filters; dewater and clean all sumps; and dewater all process units for final inspection as a condition precedent to commissioning.
- B. Commissioning team: The CONTRACTOR shall assemble a commissioning team under the direction of an individual duly authorized to commit the CONTRACTOR's personnel and resources to respond to requests from the DISTRICT. The commissioning team shall consist of representatives of the CONTRACTOR's mechanical, electrical, and instrumentation subcontractors, and others as appropriate. The commissioning team shall be available at the Site of the WORK when needed. The commissioning team shall at all times be equipped and ready to provide for emergency repairs, adjustments, and corrections to the equipment and systems installed and modified as a part of this Contract.

1.03 SUBMITTALS: The following information shall be submitted to the DISTRICT in accordance with the provisions of SECTION 01300:

- A. Detailed plans for commissioning each process unit and each system constructed or modified as a part of the WORK performed under this Contract.
- B. The CONTRACTOR's commissioning team shall include a staffing plan with names, qualifications, and telephone numbers of those assigned with both daytime and off-hour standby duty.

PART 2 - PRODUCTS

- A. Working with representatives of the DISTRICT, the Engineer, and the MANUFACTURERs and suppliers of DISTRICT or CONTRACTOR Furnished Equipment and Materials, the CONTRACTOR shall develop and produce a detailed, written plan for the start-up and initial operation, under actual operating conditions, of the equipment and systems installed and constructed under this Contract. The document, after acceptance by the DISTRICT, shall serve as the guidance manual for the commissioning process.

PART 3 - EXECUTION

- A. After completion of the equipment and system performance and operational testing, where required, and agreement on the part of the DISTRICT that the systems did meet all test requirements, commissioning will begin.
- B. The CONTRACTOR shall remove all temporary piping, bulkheads, controls and other alterations to the permanent systems that may have been needed during the performance and operational testing and

shall perform the tasks necessary to make the improvements constructed under this Contract fully operational. The DISTRICT shall confirm in writing the date(s) that the system is ready for commissioning and on which actual commissioning activities commence. Activities conducted prior to such written confirmation shall not constitute commissioning.

- C. The DISTRICT's operation and maintenance personnel will be responsible for operation of the systems to be commissioned, with guidance and support by the Commissioning Team. The portion of the WORK to be commissioned shall be fully operational, performing all functions for which it was designed.
- D. The CONTRACTOR shall be available at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being constructed.
- E. During the commissioning period, the DISTRICT shall be responsible for all normal operational costs and the CONTRACTOR shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the portion of the plant being commissioned, operational.

END OF SECTION

SECTION 01664 TRAINING

PART 1 - GENERAL

- 1.01 DESCRIPTION: This section contains requirements for training the DISTRICT's personnel, by persons retained by the CONTRACTOR specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this contract. In addition, the CONTRACTOR shall coordinate, plan and schedule training for owner furnished equipment, as specified in Contract Documents.
- 1.02 QUALITY ASSURANCE: Where required by the detailed specifications, the CONTRACTOR shall provide on-the-job training of the DISTRICT's personnel. The training sessions shall be conducted by qualified, experienced, factory-trained representatives of the various equipment manufacturers, and the CONTRACTOR will be responsible to coordinate services for DISTRICT Furnished Equipment as well as CONTRACTOR supplied equipment. Training shall include instruction in both operation and maintenance of the subject equipment.
- 1.03 SUBMITTALS: The following information shall be submitted to the DISTRICT in accordance with the provisions of SECTION 01300. The material shall be provided as a line item on the Schedule of Values. This information shall be provided not less than 3 weeks prior to the provision of training (see also paragraph 2.03):
- A. Lessons plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.
 - B. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date and time of each training session.

PART 2 - PRODUCTS

- 2.01 GENERAL: Where specified, the CONTRACTOR shall conduct training sessions for the DISTRICT's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions specified in the following paragraphs. Approved operation and maintenance manuals shall be available at least 30 days prior to the date scheduled for the individual training session. See SECTIONS 01300, 01662, and 01730.
- 2.02 LOCATION: Training sessions shall take place at the site of the work in Citrus County, Florida.
- 2.03 LESSON PLANS: Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject.
- One complete set of originals of the lesson plans, training manuals, handouts, visual aids, and reference material shall be the property of the DISTRICT and shall be suitably bound for proper organization and easy reproduction. The CONTRACTOR shall furnish ten copies of necessary training manuals, handouts, visual aids and reference materials at least 1 week prior to each training session.
- 2.04 FORMAT AND CONTENT: Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system. As a minimum, training session shall cover the following subjects for each item of equipment or system:
- A. Familiarization
 - 1. Review catalog, parts lists, drawings, etc., which have been previously provided for the plant files and operation and maintenance manuals.

2. Check out the installation of the specific equipment items.
 3. Demonstrate the unit and indicate how all parts of the specifications are met.
 4. Answer questions.
- B. Safety
1. Using material previously provided, review safety references.
 2. Discuss proper precautions around equipment.
- C. Operation
1. Using material previously provided, review reference literature.
 2. Explain all modes of operation (including emergency).
 3. Check out DISTRICT's personnel on proper use of the equipment.
- D. Preventive Maintenance
1. Using material previously provided, review preventive maintenance (PM) lists including:
 - a. Reference material
 - b. Daily, weekly, monthly, quarterly, semiannual, and annual jobs
 2. Show how to perform PM jobs.
 3. Show DISTRICT's personnel what to look for as indicators of equipment problems.
- E. Corrective Maintenance
1. List possible problems.
 2. Discuss repairs--point out special problems.
 3. Open up equipment and demonstrate procedures, where practical.
- F. Parts
1. Show how to use previously provided parts list and order parts.
 2. Check over spare parts on hand. Make recommendations regarding additional parts that should be available.
- G. Local Representatives
1. Where to order parts: Name, address, telephone
 2. Service problems
 3. Who to call
 4. How to get emergency help
- H. Operation and Maintenance Manuals
1. Review any other material submitted.
 2. Update material, as required.

2.05 VIDEO RECORDING: The DISTRICT will record each training session. The CONTRACTOR shall advise all manufacturers providing training sessions that the material will be video taped and shall make available to the DISTRICT such utility services and accommodation as may be required to facilitate the production of the video tape recording.

PART 3 - EXECUTION

- 3.01 Training shall be conducted in conjunction with the operational testing and commissioning periods. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence. The CONTRACTOR shall arrange to have the training conducted on consecutive days, with no more than 6 hours of classes scheduled for any one day. Concurrent classes shall not be allowed.
- 3.02 Acceptable operation and maintenance manuals for the specific equipment shall be provided to the DISTRICT prior to the start of any training. Video taping shall take place concurrently with all training sessions.
- 3.03 The following services shall be provided for each item of equipment or system as required in individual specification sections. Additional services shall be provided, where specifically required in individual specification sections.
- A. As a minimum, classroom equipment training for operations personnel will include:
1. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.
 2. Purpose and plant function of the equipment.
 3. A working knowledge of the operating theory of the equipment.
 4. Start-up, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.
 5. Identify and discuss safety items and procedures.
 6. Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
 7. Operator detection, without test instruments, of specific equipment trouble symptoms.
 8. Required equipment exercise procedures and intervals.
 9. Routine disassembly and assembly of equipment if applicable (as judged by the DISTRICT on a case-by-case basis) for purposes such as operator inspection of equipment.
- B. As a minimum, hands-on equipment training for operations personnel will include:
1. Identify location of equipment and review the purpose.
 2. Identify piping and flow options.
 3. Identify valves and their purpose.
 4. Identify instrumentation:
 - a. Location of primary element.
 - b. Location of instrument readout.
 - c. Discuss purpose, basic operation, and information interpretation.
 5. Discuss, demonstrate, and perform standard operating procedures and round checks.
 6. Discuss and perform the preventative maintenance activities.
 7. Discuss and perform start-up and shutdown procedures.
 8. Perform the required equipment exercise procedures.
 9. Perform routine disassembly and assembly of equipment if applicable.
 10. Identify and review safety items and perform safety procedures, if feasible.

- C. Classroom equipment training for the maintenance and repair personnel will include:
1. Theory of operation
 2. Description and function of equipment
 3. Start-up and shutdown procedures
 4. Normal and major repair procedures
 5. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings
 6. Routine and long-term calibration procedures
 7. Safety procedures
 8. Preventative maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
- D. Hands-on equipment training for maintenance and repair personnel shall include:
1. Locate and identify equipment components.
 2. Review the equipment function and theory of operation.
 3. Review normal repair procedures.
 4. Perform start-up and shutdown procedures.
 5. Review and perform the safety procedures.
 6. Perform DISTRICT approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

END OF SECTION

SECTION 01700 CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes administrative and procedural requirements for Contract Closeout including, but not limited to, the following:
 - a. Inspection procedures
 - b. Project record document submittal
 - c. Operation and maintenance manual submittal
 - d. Submittal of warranties
 - e. Final cleaning
 - f. CONTRACTOR's Certification
- B. Closeout requirements for specific construction activities are included in the appropriate SECTIONS in DIVISIONS 1 through 16.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 01050 - Field Engineering
 - 3. SECTION 01530 – Temporary Barriers and Controls

1.02 SUBSTANTIAL COMPLETION:

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, the CONTRACTOR shall satisfy the following:
 - 1. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents. Submit in accordance with SECTION 01300.
 - 2. Obtain and submit releases enabling the DISTRICT unrestricted use of the WORK and access to services and utilities. Include Certificates of Occupancy (C.O.), operating certificates, and similar releases, as required.
 - 3. Submit Record Documents, maintenance manuals, Project photographs, damage or settlement surveys, property surveys, and similar record information as specified in Paragraph 1.04. All drawings shall be scanned and submitted in accordance with SECTION 01300, and in hard copy form, 24 inch by 36 inch plan size. All other documents shall also be scanned and submitted in accordance with SECTION 01300.
 - 4. Complete final cleanup requirements.
- B. Inspection Procedures: On receipt of a request for inspection, the DISTRICT will either proceed with inspection or advise the CONTRACTOR of unfilled requirements. The DISTRICT will prepare the Certificate of Substantial Completion following inspection or advise the CONTRACTOR of WORK that must be completed or corrected before the certificate will be issued.
 - 1. The DISTRICT will reschedule the inspection when in its opinion, the WORK is substantially complete.

1.03 FINAL ACCEPTANCE:

- A. Preliminary Procedures: Submit notification by CONTRACTOR that WORK has been completed in accordance with the Contract Documents to the knowledge of the CONTRACTOR. Before requesting final inspection, complete the following:
 - 1. Submit the final payment request with releases and supporting documentation. Include insurance certificates for products and completed operations where required.

2. Submit a certified copy of the DISTRICT's inspection list of items to be completed or corrected. The certified copy of the list shall state that each item has been completed.
 3. Submit consent of surety to final payment.
 4. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 5. Submit Release of Liens (from the Prime, and all Subcontractors, Vendors and Suppliers).
 6. The above shall be submitted in accordance with SECTION 01300.
- B. Reinspection Procedure: The DISTRICT will reinspect the WORK upon receipt of notice that the WORK, including inspection list items from earlier inspections, has been completed.
1. Upon completion of reinspection, the DISTRICT will advise the CONTRACTOR of WORK that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection will be repeated.
- C. Return all keys furnished by the DISTRICT.

1.04 RECORD DOCUMENT SUBMITTALS:

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the DISTRICT's reference during normal working hours.
- B. As-Built Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Drawings and Shop Drawings. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set. Mark the set to show the actual installation where the installation varies substantially from the WORK as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Call attention to each entry by drawing a "cloud" around the areas affected.
- C. The DISTRICT will make electronic copies of whatever electronic versions of the Drawings exist, available to the CONTRACTOR for As-Built purposes. The CONTRACTOR must obtain concurrence of the DISTRICT as to form and content of record information provided in electronic format prior to proceeding, but in general, information similar to that shown below needs to be similarly provided.
1. Record information concurrently with construction progress.
 2. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the WORK. Mark each document "AS-BUILT DRAWINGS" in neat, large, printed letters.
 3. Mark as-built invert elevations for all water control structures, culverts, etc. Refer to SECTION 01050 for structures which require a permanent benchmark.
 4. Mark new information that is important to the DISTRICT that is not shown on Drawings or Shop Drawings.
 5. Note related change-order numbers where applicable.
 6. Include the following:
 - a. Where Submittals (like Shop Drawings) are used for mark-up, record a cross-reference at corresponding location on Drawings.
 - b. Field changes of dimension and detail.
 - c. Changes made by Change Order or other Modifications.
 - d. Details not on original Contract Drawings.
 - e. As-Built shall include a plot of the actual excavation cross-sections plotted at the same station as and on top of the design cross-sections.

- f. As-Built shall include a plot of the actual levee and embankment cross-sections plotted at the same station as and on top of the design cross-sections.
 - g. Give particular attention to concealed elements that would be difficult or expensive to locate at a later date.
 - h. GPS (global positioning system) coordinates of major structures using the format lat/long DD (decimal/degree) NAD83/2007 (North American Datum).
7. Record Specifications: Maintain one (1) complete copy of the Contract Documents including addenda. Include with the Contract Documents one (1) copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
 8. Mark these documents to show substantial variations in actual WORK performed in comparison with the text of the Specifications and modifications.
 9. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 10. Note related As-Built information and Product Data.
 11. Upon completion of the WORK, submit record Specifications to the DISTRICT for the DISTRICT's records on CD in PDF format.
 12. Include the following:
 - a. MANUFACTURER, trade name, catalog number, and Supplier of each product and item of equipment actually installed, including optional and substitute items
 - b. Changes made by Addendum, Change Order, or other Modifications
 - c. Related Submittals
 13. Affix the CONTRACTOR's corporate seal on the cover sheet indicating the documents within are representative of the as-built condition of the Project. The seal shall be signed by an officer of the company.
- D. Record Product Data: Provide one (1) copy of each Product Data submittal. Note related Change Orders and markup of Record Documents.
1. Mark these documents to show significant variations in actual WORK performed in comparison with information submitted. Include variations in products delivered to the Site and from the MANUFACTURER's installation instructions and recommendations.
 2. Give particular attention to concealed products and portions of the WORK that cannot otherwise be readily discerned later by direct observation.
- E. Record Sample Submitted: Immediately prior to Substantial Completion, the CONTRACTOR shall meet with the DISTRICT's personnel at the Project Site to determine which Samples are to be transmitted to the DISTRICT for record purposes. Comply with the DISTRICT's instructions regarding packaging, identification, and delivery to the DISTRICT.
- F. Miscellaneous Record Submittals: Refer to other Specification SECTIONS for requirements of miscellaneous record keeping and submittals in connection with actual performance of the WORK. Immediately prior to the date or dates of Substantial Completion (unless otherwise specified), complete miscellaneous records and place in good order. Identify miscellaneous records properly, bind or file, and submit to the DISTRICT for the DISTRICT's records.
- G. Warranties and Bonds: Submit original documents as specified in Section 00700 - General Terms & Conditions, Supplemental Conditions, SECTION 01300, and technical specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 FINAL CLEANING:

- A. General: Regular Site cleaning is included in SECTION 01530.

- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with MANUFACTURER's instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
 - a. Clean the Site of rubbish, litter, and other foreign substances. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
 - b. Remove temporary structures, tools, equipment, supplies, and surplus materials.
 - c. Remove temporary protection devices and facilities which were installed to protect previously completed WORK.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the WORK during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the DISTRICT's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Site and dispose of lawfully.
 - 1. Where extra materials of value remain after completion of associated WORK, they become the DISTRICT's property. Dispose of these materials of no value to the DISTRICT as directed by the DISTRICT.
- E. Repairs:
 - 1. Repair damaged protective coated surfaces.
 - 2. Repair roads and other items damaged or deteriorated because of construction operations, including those which have been damaged, but are not located within the Project limits.
 - 3. Restore all ground areas affected by construction operations.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE: Operation and Maintenance (O&M) instructions shall be provided in accordance with this section and as required in the technical sections of this project manual. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this contract.

A. O&M instructions must be submitted and accepted before on-site training may start.

1.02 TYPES OF INFORMATION REQUIRED:

A. General: O&M information shall contain the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts. See SECTION 01300 for details on how to prepare and submit this data. In addition, one or more of the following items of information shall be provided as applicable.

B. Operating Instructions: Specific instructions, procedures, and illustrations shall be provided for the following phases of operations:

1. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.
2. Operator Prestart: Provide requirements to set up and prepare each system for use.
3. Start-Up, Shutdown, and Post Shutdown Procedures: Provide a control sequence for each of these operations.
4. Normal Operations: Provide control diagrams with data to explain operation and control of systems and specific equipment.
5. Emergency Operations: Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.
6. Operator Service Requirements: Provide instructions for services to be performed by the operator such as lubrication, adjustments and inspection.
7. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or each piece of equipment and describe conditions under which equipment should not be allowed to run.

C. Preventive Maintenance: The following information shall be provided for preventive and scheduled maintenance and repair:

1. Lubrication Data: Provide the following lubrication data, other than instructions for lubrication in accordance with paragraph 2.B.6.
 - a. A table showing recommended lubricants for specific temperature ranges and applications
 - b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities
 - c. A lubrication schedule showing service interval frequency
2. Preventive Maintenance Plan and Schedule: Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and

economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

- D. Corrective Maintenance: Manufacturer's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.
1. Troubleshooting Guides and Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
 2. Wiring Diagrams and Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits, including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.
 3. Maintenance and Repair Procedures: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.
 4. Removal and Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of test illustrations.
 5. Spare Parts and Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.
 6. Corrective Maintenance Man-Hours: Provide manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.
- E. Appendices: The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance of the product or equipment.
1. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.
 2. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.
 3. Personnel Training Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.
 4. Testing Equipment and Special Tool Information: Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.03 TRANSMITTAL PROCEDURE:

- A. Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with SECTION 01300. Only complete sets of O&M instructions will be reviewed for acceptance.
- B. Three copies of the specified O&M information shall be provided. For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment numbers it appears in the project manual. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information. Binders shall be 3-inch, D-ring, presentation type with locking mechanism and clear view vinyl cover for insertion of graphic identifying contents of binder.
- C. If manufacturers' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

1.04 PAYMENT:

- A. Acceptable O&M information for the project must be delivered to the DISTRICT prior to the project being [85] percent complete. Progress payments for work in excess of [85] percent completion may be reduced until the specified acceptable O&M information has been delivered to the DISTRICT.

1.05 FIELD CHANGES:

- A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented by the CONTRACTOR to reflect any field changes or information requiring field date.

END OF SECTION

SECTION 02050 DEMOLITION

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work: The CONTRACTOR shall include the removal of existing construction to limits indicated on drawings where earthwork or other construction operations are to be performed as specified herein. The DISTRICT shall not be responsible for the condition of any items to be removed or salvaged.

1. 02110 Clearing and Land Prep
2. 0506 Welding

1.02 APPLICABLE PUBLICATIONS: (Not Used)

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS:

A. Schedule of Demolition:

1. Submit proposed methods and operations of demolition for review and approval by the DISTRICT prior to the start of WORK.

B. Permits:

1. The CONTRACTOR shall be responsible for acquiring appropriate necessary permits for the work. Copies of the permits shall be submitted to the DISTRICT prior to commencement of demolition.

1.05 QUALIFICATIONS: (Not Used)

1.06 RESPONSIBILITIES:

A. The CONTRACTOR shall not commence demolition of structure(s) prior to written permission of the DISTRICT.

B. Condition of structures to be demolished:

1. The DISTRICT assumes no responsibility for actual condition of structures to be demolished.
2. Conditions existing at time of inspection for bidding purposes will be maintained by DISTRICT insofar as practicable.

C. The CONTRACTOR shall remove all such foundations to one foot below the proposed sub-grades.

D. Explosives: The use of explosives will not be permitted. The CONTRACTOR may use a non-explosive, expanding agent in drilled holes for the demolition of concrete, and shall conform to all manufacturers' recommendations, including safety precautions for mixing and placing the agent.

E. The CONTRACTOR shall ensure the safe passage of persons around the area of demolition and clearing. The CONTRACTOR shall conduct operations to prevent injury to adjacent structures, other facilities, and any persons.

1. The CONTRACTOR shall protect existing finish work that is to remain in place from damage due to demolition operations.

F. Traffic:

1. The CONTRACTOR shall conduct operations and the removal of debris to ensure minimum interference with existing access roads and other adjacent, occupied or used facilities.
 2. Do not close, block or otherwise obstruct access roads or other occupied or used facilities without permission from the DISTRICT.
- G. The CONTRACTOR shall promptly repair damages caused to adjacent facilities by demolition operations at no cost to the DISTRICT.
- H. Utilities Disconnection:
1. The CONTRACTOR shall perform all necessary coordination to locate, disconnect, relocate, and/or protect as needed all existing underground, aboveground, and overhead utilities within the limits of demolition prior to commencement of demolition operations. All expenses incurred for the coordination with utility companies and agencies, shall be at no cost to the DISTRICT.
 2. The CONTRACTOR shall promptly repair damages to existing utilities that are to remain, at no cost to the DISTRICT.

1.07 CERTIFICATIONS AND TESTING: (Not Used)

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: (Not Used)

PART 2 - PRODUCTS

2.01 SALVAGE MATERIALS:

- A. The CONTRACTOR shall salvage and store the following material for the DISTRICT's use:
1. Any salvaged rip-rap may not be utilized where new bank and shore rip-rap is proposed.
 2. Undesirable concrete, rip-rap stone rubble shall not be stockpiled within proposed project footprints.
 3. Existing staff gauges, actuators and stems to be retained by the DISTRICT. Special care shall be taken during demolition to avoid damage so that these items may be re-used in the future.

PART 3 - EXECUTION

3.01 DEMOLITION:

- A. The CONTRACTOR shall provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
- B. If hazardous materials are found, the CONTRACTOR shall notify the DISTRICT immediately.
- C. The CONTRACTOR shall completely backfill below-grade areas and voids resulting from demolition work. The CONTRACTOR shall provide fill consisting of approved soil, gravel or sand (free of trash and debris) and compact fill to approximate density of surrounding native soil.

3.02 DISPOSAL OF DEMOLISHED MATERIALS:

- A. The CONTRACTOR shall remove debris, rubbish, and other materials resulting from demolition operations.

- B. If hazardous materials are encountered during demolition operations, the CONTRACTOR shall comply with all applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
- C. The CONTRACTOR shall transport materials removed from demolished structures and properly dispose of them at an approved site according to the State, Federal, and local regulations.

3.03 CONNECTIONS TO EXISTING CONSTRUCTION:

- A. The CONTRACTOR shall cut and remove portions of existing construction as required to allow proper installation of new construction.
- B. The CONTRACTOR shall shore, brace and maintain existing structure(s) in a safe condition until permanent supports are completed.
- C. The CONTRACTOR shall repair all damage as a result of installation of shoring and bracing.

3.04 CLEANUP AND REPAIR:

- A. Upon completion of demolition work, the CONTRACTOR shall remove all tools, equipment, and demolished materials from site; see SECTION 1.01 and SECTION 3.02 of this specification.
- B. The CONTRACTOR shall repair demolition performed in excess of that required and return structures and surfaces to conditions existing prior to commencement of demolition work. The CONTRACTOR shall repair adjacent construction or surfaces soiled or damaged by demolition work to the satisfaction of the DISTRICT.
- C. The CONTRACTOR may burn combustible products of the demolition operation on site provided the written approval is obtained from the DISTRICT for burn locations and methods, including methods for preventing uncontrolled spread of the burn. The CONTRACTOR shall obtain the proper permits before DISTRICT'S final approval.
- D. The CONTRACTOR shall remove or modify as indicated all existing construction within the construction limits to the extent necessary to permit construction of the work. The CONTRACTOR shall properly dispose of the material at an approved site according to the State, Federal, and local regulations.

END OF SECTION

SECTION 02100 SITE PREPARATION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials, and equipment necessary for complete and proper site preparation within the areas shown on the Drawings and specified herein and observe permit conditions.

1.02 APPLICABLE PUBLICATIONS:

- A. Applicable Standards:
 - 1. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition (FDOT)

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: (Not Applicable)

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall make all excavations for piping and appurtenant structures in any material encountered to the depth and grades required, shall backfill such excavations and dispose of excess or unsuitable materials from excavation, and shall provide and place necessary borrow material to properly backfill excavations, all as indicated on the drawings and specified herein.
- B. Excavation, dewatering, sheeting and bracing required shall be carried out so as to prevent any possibility of undermining or disturbing the foundations of any existing structure or work, and so that all work may be accomplished and inspected in the dry, except as approved by the DISTRICT. Aqueous construction may be performed only with prior approval of the DISTRICT.

1.07 CERTIFICATIONS AND TESTINGS: (Not Applicable)

1.08 INSPECTION COORDINATION: (Not Applicable)

1.09 WARRANTY: (Not Applicable)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 TRAFFIC CONTROL: The CONTRACTOR shall provide proper warning devices and barriers for protection of the public and workmen in accordance with FDOT Specification Section 102-3 Traffic Control and local regulations.

3.02 STANDARD CLEARING AND GRUBBING: Standard site clearing and grubbing, in accordance with FDOT Specification Section 110.2, shall be performed within the areas shown on the Drawings or otherwise noted in the above referenced specification.

- 3.03 EROSION CONTROL: The CONTRACTOR shall prevent and control erosion and water pollution as per FDOT Specification Sections 104-1, 2, 3, 4, 6 and 7 and Florida Department of Environmental Protection (FDEP) regulations and permit conditions.
- 3.04 PROTECTION AND/OR RELOCATION OF EXISTING FACILITIES: Existing facilities such as storm drains, roadways, water lines, light poles, conduits, fences, utility and telephone lines, etc. are to be carefully protected from damage during all phases of the construction. The CONTRACTOR shall make all necessary arrangements with the owner of the facility and be responsible for all costs involved in the proper protection, relocation or other work that such owners deem necessary.
- 3.05 UNDERGROUND UTILITIES: The CONTRACTOR shall provide all necessary liaisons with other utilities (underground) by notification, 48 hours in advance, of any digging by telephoning the appropriate Utility Notification Center and local utilities.

END OF SECTION

SECTION 02110 CLEARING AND LAND PREPARATION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall include the removal of trees and other vegetation from areas where earthwork or other construction operations specified herein are to be performed. This section also includes land preparation activities for excavation and fill areas.
 - 1. SECTION 1300 - Submittals
 - 2. SECTION 02050 - Demolition
 - 3. SECTION 02200 - Earthwork
 - 4. SECTION 02221 - Trenching, Backfilling and Compacting

1.02 APPLICABLE PUBLICATIONS:

- A. Florida Department of Transportation (FDOT)
 - 1. 104 – Specification Prevention, Control, and Abatement of Erosion and Water Pollution

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. Prior to beginning the WORK, CONTRACTOR shall submit a detailed plan for clearing and land preparation in conformance with SECTION 01300. The plan shall detail the sequence of WORK and describe the CONTRACTOR's planned method of clearing and land preparation activities.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall ensure the safe passage of persons around areas of clearing and land preparation. The CONTRACTOR shall conduct its operations to prevent injury to adjacent structures, vegetation designated to remain, other facilities and persons.
- B. Traffic:
 - 1. The CONTRACTOR shall conduct its operations and the removal of cleared materials to ensure minimum interference with existing access roads and other adjacent occupied or used facilities.
 - 2. The CONTRACTOR shall not block or otherwise obstruct access roads or other occupied or used facilities without permission from the DISTRICT. Where blockage is allowed, the CONTRACTOR shall provide alternate routes around closed or obstructed traffic ways.
- C. The CONTRACTOR may commence clearing or land preparation within portions of the project falling within the limits of temporary construction easements or utility Right-of-Way only with specific permission from the DISTRICT for each activity and location. All requirements under A and B above apply within these limits.

1.07 CERTIFICATIONS AND TESTING: (Not Applicable)

- 1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 advance hours notice of its intention to begin new WORK activities.

1.09 WARRANTY: (Not Applicable)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 GENERAL CLEARING:

- A. The CONTRACTOR shall remove the majority of the above grade non-native vegetative matter in the areas indicated on the plans. The CONTRACTOR shall complete the work of Clearing and Land Preparation as outlined below.
1. Mowing or the use of a bush-hog may be required in areas of heavy grass, weeds, or woody-stalked vegetation.
 2. Completely remove all designated exotic/hazardous trees within the designated project boundaries.
 3. All woody debris that measures over three-quarters inch in diameter and longer than 18-inches shall be removed.
 4. All stumps shall be ground level to six inches below the surrounding ground level. Stumps on the slopes shall be cut flush with the natural angle of the existing grade and treated immediately with a herbicide approved by the DISTRICT. All seedlings within the project site shall be treated with the herbicide.
 5. All plant material (whole or chipped) will be removed from the project area and stockpiled at a location authorized by the DISTRICT. Disposal of the stockpile shall be accomplished at a maximum of every fifteen (15) workdays.
 6. Remove any garbage or other waste debris recovered during clearing.
 7. On completion of the clearing, remove all sticks, rubbish and other extraneous material and rake the ground surface in order to leave a smooth and clean appearance.
 8. Clearing and land preparation shall proceed sufficiently ahead of earthwork activities to minimize disruption and allow time for determination of the adequacy of the clearing procedure.
 9. All WORK shall be performed in accordance with approved principles of modern arboricultural methods.
 10. All trees to remain in the project area, as designated by the DISTRICT, shall be protected from damage by tree barricades.
 11. All WORK shall be performed without damage to existing amenities, including trees and shrubs. The CONTRACTOR shall be responsible for repair and replacement of existing amenities to the satisfaction of the DISTRICT. The CONTRACTOR shall protect all vegetation, habitats, or amenities on the project location as indicated on the plans.
- B. The CONTRACTOR shall clear adjacent to cut or fill sections to a minimum distance of ten (10) feet outside of slope lines unless lesser distances are specified. Clearing in areas of native vegetation for levee construction or removal and canal excavation shall be limited to a distance of 10 feet outside of slope lines.
- C. The CONTRACTOR may burn combustible products of the clearing operation on the site with the written approval of the DISTRICT and with permission of the local authorities. The CONTRACTOR shall comply with all local ordinances or regulations for burn locations and methods, including methods for preventing uncontrolled spread of the burn. The CONTRACTOR shall provide the DISTRICT with copies of permits prior to burning.

- D. The CONTRACTOR may not burn cleared materials within the limits of any utility Right-of-Way without written permission of the controlling agency. The CONTRACTOR will be required to collect and haul all cleared materials to an approved site for burning and disposal.
- E. The CONTRACTOR shall limit burning to days when groundwater levels are adequate to prevent ignition of peat soils located throughout the project areas.

3.02 CLEARING WITHIN AREAS OF NATIVE VEGETATION:

- A. The CONTRACTOR shall remove exotic trees/plants, hazardous material, trash, and debris and leave the site clean with a smoothly raked finish grade. Every reasonable effort shall be made to protect native vegetation designated to remain. Areas disturbed by work operations, such as, but not limited to, access points beyond the limits of the right-of way, shall be restored to original or better condition, including, but not limited to, filling, grading, sodding, and seeding/mulching as direct by the DISTRICT.

3.03 EROSION CONTROL:

- A. The CONTRACTOR shall prevent and control erosion and water pollution as per FDOT Specification Sections 104 -1, 2, 3, 4, 6 and 7 and Florida Department of Environmental Protection (FDEP) regulations and permit conditions.

END OF SECTION

SECTION 02200 EARTHWORK

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment, and materials for all excavating, trenching, filling, construction of embankment, backfilling, compacting, grading, and all related items of earthwork necessary to complete the WORK indicated or specified.
1. SECTION 02050 Demolition
 2. SECTION 02110 Clearing and Land Preparation
 3. SECTION 02220 Excavation and Backfilling
 4. SECTION 02221 Trenching, Backfilling and Compacting
 5. SECTION 02401 Dewatering and Cofferdam

1.02 APPLICABLE PUBLICATIONS:

- A. American Society of Testing Materials (ASTM):
1. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Standard Effort (12,400 ft-lbf/ ft³ (600 kN-m/m³)).
 2. D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
 3. D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Modified Effort (56,000 ft-lbf/ ft³ (2,700 kN-m/m³)).
 4. D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 5. D2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
 6. D3740 – Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 7. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 8. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 9. D4564 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sleeve Method.
 10. D4914 – Standard Test Methods for Density and Unit Weight of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
 11. D5030 – Standard Test Method for Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
 12. D6938 – Standard Test Method for In-place Density and Water Content of Soil and Soil-Aggregate by Nuclear Method Shallow Depth.
 13. E329 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- B. Florida Department of Transportation (FDOT):
1. Standard Specifications for Road and Bridge Construction (latest edition).
- C. American Association of State Highway Transportation Officials (AASHTO):

1. AASHTO T 27 – Sieve Analysis of Fine and Course Aggregates.
 2. AASHTO T 99 - Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.
- D. Florida Method (FM) of Test:
1. FM T-1 011 – Florida Method of Test for Sampling Aggregates.
- E. Miscellaneous Project Data:
1. Subsurface soil data logs are provided for the CONTRACTOR’S reference.
 - a. Report of Geotechnical Engineering Services (for Tsala Apopka Golf Course Structure Modification), Tierra, Inc., September 21, 2018.

1.03 DEFINITIONS [if applicable]:

- A. **Select Backfill:** Select backfill shall be clean, well-graded material free from debris, peat, roots, seeds of nuisance or exotic species, organic material, clods, and stones with a diameter greater than 3 inches (76 mm) in any direction. Select backfill shall have an average organic content of not more than 2%. Select backfill shall be placed where indicated on the Drawings. Select backfill is required where higher control of materials and placement is needed such as water retaining embankment cores, roadway embankments, and adjacent to structures.

Select backfill may be material excavated for the WORK (native) or may be imported. The CONTRACTOR may blend native materials to achieve a material that meets the requirements for select backfill. Select backfill shall meet the following Unified Soil Classification System (ASTM D2487) designations:

1. **Levee and Water Retaining Embankments:** CL, ML (These are fine-grained soils with -50-75% by dry weight passing through a No. 200 sieve; CL and ML are inorganic clay and silt, respectively, with a liquid limit less than 50%.) Levee fill material shall not contain any particles larger than 3 inches (76 mm) in diameter, and the upper 1-foot of the levee shall not contain particle sizes larger than 2 inches (51 mm) in diameter.
2. **Structure Backfill:** SW, SP, SC (These are coarse-grained soils with greater than 50% by dry weight retained on a No. 200 sieve; SP and SW have less than 5% finer than a No. 200 sieve; SC has 12-50% finer than a No. 200 sieve.)

The following table displays select backfill maximum lift thickness and maximum particle size.

| SELECT BACKFILL | | |
|--------------------------------|------------------------------|-------------------------------------|
| STRUCTURE TYPE | MAXIMUM PARTICLE SIZE | MAXIMUM LOOSE LIFT THICKNESS |
| Water Bearing Levee | 3 inches | 6 inches |
| Non-Water Bearing Levee | 3 inches | 12 inches |
| Dam/Embankment | 3 inches | 12 inches |

Select Backfill shall meet the following FDOT gradation limits (AASHTO T27 and FM 1-T 011):

| BACKFILL GRADATION LIMITS | |
|----------------------------------|----------------------------|
| SIEVE SIZE | PERCENT PASSING (%) |

| | |
|--------------------|--------|
| 3 ½ inches [90 mm] | 90-100 |
| ¾ inch [19 mm] | 70-100 |
| No. 4 [4.75 mm] | 30-100 |
| No. 40 [425 µm] | 15-100 |
| No. 100 [150 µm] | 5-65 |
| No. 200 [75 µm] | 0-15 |

- B. **Random Backfill:** Random backfill shall be clean, well-graded material, that is thoroughly mixed and free from debris, clods, seeds of nuisance or exotic species, and stones with a diameter in any direction greater than those specified in the below table. Random backfill shall have an organic content of less than 5% by weight. Tighter restrictions on stone size are considered in the top layer of fill, as per subsection 3.03 F. Final Dressing of Slopes, if the area is to be seeded, sodded, or landscaped. Random backfill shall be placed where indicated on the Drawings. Random backfill is required where stable backfill is needed to maintain slopes and grades, but shall not retain water or be adjacent to structures.

Random backfill may be material excavated for the WORK (native) or may be imported. The CONTRACTOR may blend native materials to achieve a material that meets the requirements for random backfill. Random backfill shall meet the CH (inorganic clays of high plasticity) Unified Soil Classification System (ASTM D2487) designation in addition to the classifications identified for select backfill.

Random backfill shall meet the below requirements with the largest particle diameter not exceeding 0.9 of the compacted layer thickness.

| RANDOM BACKFILL | | |
|------------------------------|----------------------|---|
| MAXIMUM PARTICLE SIZE | SURFACE DEPTH | MAXIMUM COMPACTED LIFT THICKNESS |
| 3 ½ inches | < 12 inches | 6 inches |
| 6 inches | 12-24 inches | 12 inches |
| 12 inches | > 24 inches | 12 inches |

- C. **Unclassified Fill:** Unclassified Fill may be material used to bring areas to grade where there is no potential for slope erosion and the fill will not support a structure of critical function. Unclassified backfill shall be placed where neither select backfill nor random backfill are shown on the Drawing. Unclassified Backfill shall be free from seeds of nuisance or exotic species, and will be composed of material excavated for the WORK or imported material that can be compacted to the required density.
- D. **Levee Fill Material:** Levee fill material shall consist of clean, granular materials that are free of debris, cinders, combustibles, roots, sod, wood, cellulose, organic material and materials subject to termite attack. Levee fill shall not have more than 12% passing the U.S. Standard Number 200 sieve (dry weight basis). The maximum particle size shall be 12 inches (305 mm) in any direction. Particles between 8 inches (203 mm) and 12 inches (305 mm) in diameter are considered “oversized materials” and shall not exceed 10% by volume of the levee fill material.
- E. **Drain/Filter Sand:** Drain/Filter sand shall be imported silica sand to be used in the construction of the horizontal blanket drain and the diaphragm filter/drain around the discharge structure box culverts

- penetrating the reservoir embankment, and filter material beneath the GC (gravel, sand, and clay mixtures) and/or GM (gravel and silt mixtures) material in the perimeter canal.
- F. Unified Soil Classification System (USCS): USCS is a two-letter classification system used to describe the texture and grain size of a soil. In the USCS system, letters are representative as follows: G stands for gravel, S stands for sand, M stands for silt, C stands for clay, O stands for organic, P stands for poorly graded, W stands for well graded, H stands for high plasticity, and L stands for low plasticity.
 - G. Chimney Drain: A vertically inclined drain within the downstream portion of the embankment extending from the interior edge of the horizontal blanket drain to the normal full storage level. This drain will consist of GC and/or GM materials.
 - H. Blanket Drain: A horizontally inclined drain installed at the construction phase to aid in embankment stabilization. The blanket drain can be used against various types of slopes and is composed of GC and/or GM materials. A blanket drain is used to disperse low-velocity flows rather than concentrating them.
 - I. Core: A core is composed of select fill and relatively impervious material, located in the center of the embankment, and defined by a 1H:2V slope. The minimum top width of the core shall not be less than 10 feet. For dams, the coefficient of permeability of the core material shall be 10^{-4} cm/sec or less. More permeable core material may be accepted if seepage is adequately controlled and appropriate factors of safety are met. A series of graded material transition zones, consisting of random fill, shall abut the core on all sides.
 - J. Excavation: Excavation shall be the removal of all materials within the defined configuration to the limits of excavation shown on the Project Drawings, excluding stripping material.
 - K. Unsuitable Fill: Soil that does not meet the requirements for fill (or backfill) addressed thus far in this SECTION shall be considered unsuitable fill soil.
 - L. Cohesionless materials: These materials include gravels, gravel-sand mixtures, sands, and gravelly sands and are generally exclusive of clayey and silty materials (clayey and silty materials are free-draining, so impact compaction does not produce a well-defined moisture-density relationship curve).
 - M. Cohesive materials: These materials include silts and clays and are generally exclusive of sands and gravel (sands and gravel are materials for which impact compaction produces a well-defined moisture-density relationship curve).

1.04 SUBMITTALS: The CONTRACTOR shall submit field measured cross-sections at each design cross-section for record purposes for canal excavations and levee embankments as described in this SECTION. The submittal of the field measured cross-sections shall be signed and sealed by a State of Florida licensed land surveyor. The CONTRACTOR shall submit to the DISTRICT detailed Work Plans for all work indicated or specified in this SECTION at least 14 days before the work is scheduled to begin.

1.05 QUALIFICATIONS:

- A. Geotechnical Testing Agency Qualifications: The CONTRACTOR will engage and pay for an independent testing agency qualified according to ASTM E 329 to perform Quality Control. This Quality Control involves conducting soil materials and rock-definition testing during earthwork operations, as documented according to ASTM D 3740.
- B. Earthwork Contractor Qualifications: The CONTRACTOR shall use an adequate number of skilled laborers and installers who are thoroughly trained and have a minimum of 5 years of successful experience in the necessary crafts and are completely familiar with the code requirements, the contract provisions, and the methods needed for the proper performance of the WORK of this SECTION. The CONTRACTOR shall employ the adequate resources and equipment necessary to successfully perform the WORK of this SECTION on schedule.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall excavate any material encountered to the depth and grades required, shall backfill such excavations as required, and shall dispose of excess or unsuitable materials from excavation as approved by the DISTRICT. The CONTRACTOR shall provide and place necessary borrow material to properly backfill excavations as indicated on the Drawings and specified herein.
- B. Excavation, dewatering, sheeting, and bracing required shall be carried out so as to prevent any possibility of undermining or disturbing the foundations of any existing structure or WORK, and so that all WORK may be accomplished and inspected in the dry. Aqueous construction may be performed only with prior written approval of the DISTRICT. Excavation and backfilling shall be in accordance with SECTION 02200 - Excavation and Backfilling.
- C. The CONTRACTOR shall furnish the services of a State of Florida licensed land surveyor for the field layout of all work indicated or specified in this section. The CONTRACTOR'S licensed land surveyor shall perform all initial site layout and shall provide follow-up verification of all work underway at a frequency of no less than once a week.

1.07 CERTIFICATIONS AND TESTING: CONTRACTOR shall furnish, at his own expense, all field density testing required to establish and maintain individual Quality Control (QC) processes required or specified in this SECTION. Field density tests shall be in accordance with ASTM Standards (some referenced herein) appropriate to each type of material used in backfilling. Failure to meet the specified density will require the CONTRACTOR to recompact and retest, at his own expense, those areas requested by the DISTRICT.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours advanced notice of his intention to begin new WORK activities.

1.09 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents - General Terms and Conditions.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS ENCOUNTERED:

- A. The CONTRACTOR shall excavate materials to include existing rip-rap lining the upstream and downstream canal channel.
- B. The CONTRACTOR shall consider all materials encountered in excavations as suitable for use in random fill, provided that they consist of two or more well-graded soils and achieve the required compaction as specified in this SECTION.
- C. The CONTRACTOR shall consider all materials encountered, regardless of type, character, composition and condition thereof unclassified other than as indicated in Article 1.03 Definitions. The CONTRACTOR shall estimate the quantity of various materials included prior to submitting the Bid Form. Rock encountered shall be handled by the CONTRACTOR at no additional cost to DISTRICT.

PART 3 - EXECUTION:

3.01 SITE PREPARATION:

- A. Clearing and Demolition: The CONTRACTOR shall perform clearing and demolition as specified in SECTION 02110 - Clearing and Land Preparation and SECTION 02050 - Demolition.
- B. Levee Roads: The CONTRACTOR shall place and compact a 6 inch thick by 14 foot wide layer of lime rock or shell rock gravel along the entire top length of the perimeter and intermediate levees to create the levee road and meet the design grade.

3.02 EXCAVATION AND TRENCHING:

- A. Trenching for Pipes: The CONTRACTOR shall perform trenching for pipes as shown, required, and specified in accordance with SECTION 02221 - Trenching, Backfilling and Compacting,
- B. Sheet piling and Bracing: The CONTRACTOR shall provide sheet piling and bracing as required or shown in accordance with the following provisions.
 - 1. Use when required by the specifications or Drawings and where resulting slopes from excavation or trenching might endanger the structural integrity of in-place or proposed structures.
 - 2. Provide materials on site prior to start of excavation. Adjust spacing and arrangement as required by conditions encountered.
 - 3. Remove sheet piling and bracing as backfill progresses. Fill voids left after withdrawal with sand or other approved material.
 - 4. In-place structures damaged by sheet piling and bracing activities shall be repaired by the CONTRACTOR at no additional cost to the District.
 - 5. Comply with all applicable sections of OSHA.
 - 6. Comply with all requirements of the Florida Trench Safety Law as specified in the GENERAL TERMS & CONDITIONS.
- C. Blasting: If required and approved by the DISTRICT, the CONTRACTOR shall perform blasting in accordance with the SECTION 02211- Blasting.
- D. Excavation for Structures: The CONTRACTOR shall perform excavation for structures as shown, required and specified below:
 - 1. Excavate area adequate to permit efficient erection and removal of forms.
 - 2. Trim to neat lines where details call for concrete to be deposited against earth.
 - 3. Excavate by hand in areas where confined space and access restricts the use of machines.
 - 4. Notify the DISTRICT immediately when excavation has reached the depth indicated on plans.
 - 5. Restore bottom of excavation to proper elevation with concrete in areas that are over excavated.
 - 6. Conform to the requirements of SECTION 02221 – Trenching, Backfilling, and Compacting.
- E. Canal Excavation: The CONTRACTOR shall perform canal excavation by any method meeting the requirements of these specifications and the Drawings. Transitions in bottom width and elevation shall be uniform. The excavated slopes and bottom of the canals shall be left as smooth as skilled use of the excavating equipment will permit.
 - 1. A construction tolerance of 0.25 foot above or below the lines and grades indicated shall be permitted; however, the canal cross sectional area shall not be less than designed.

- a. The CONTRACTOR shall provide field measured cross-sections of the “As-Built” conditions to the DISTRICT, plotted at the same stations as the detailed cross-sections shown on the plans to show the above specified tolerance has been met.
 - 2. Where select fill is specified, the CONTRACTOR shall exercise care in excavation to avoid, to the maximum practicable extent, mixing of peat with materials suitable for use in select fill.
 - 3. Materials suitable for use in select fill shall be deposited along the levee foundation in quantities sufficient for subsequent construction of the select fill. Random fill materials shall be deposited along each side of the central portion of the levee.
 - 4. Sufficient quantities of peat or topsoil may be placed near the limits of fill (levees) for use in final dressing of fill side slopes.
- F. Canal Cleaning: The CONTRACTOR shall clean existing canals to the lines and grades shown on the Drawings. All deposited sand, silt, and organic matter shall be removed and stockpiled or disposed of as approved by the DISTRICT.
- G. Demucking: The CONTRACTOR shall remove all organic soils from areas below structures, piping, and road subgrades to the lines and grades as shown in the Drawings. Materials excavated shall not be used for backfill of structures or pipes and shall be placed in random fill zones only. Organic soils (including peat) shall be used in random fill in the top layer of the final dressing of the levee.
- H. Excavation of Existing Levees and Embankments: The CONTRACTOR shall perform excavation by any method acceptable to the DISTRICT and by meeting the requirements of these specifications and the Drawings. All materials removed from levees and embankments shall be suitable for reuse as random fill. Excavation limits shall be clearly identified and approved by the DISTRICT prior to initiation of the WORK.
- I. Cross-Sections: For progress payments and record purposes, the Contractor shall submit field measured cross-sections as required by the DISTRICT.

3.03 EMBANKMENT:

- A. Levee Embankment:
- 1. Levee embankment shall consist of a select backfill core and random backfill side slopes (unless otherwise indicated) and shall be placed to the lines and grades as shown on the Drawings. At no location shall the completed top elevation be lower than indicated. Levee side slopes indicated are nominal, and may be varied. Completed side slopes shall be uniform from top to toe of the levee, and shall be smoothly transitioned. The CONTRACTOR shall perform embankment WORK as shown on the Drawings, required and in accordance with these specifications.
 - a. Materials suitable for select fill shall be placed in the central core of the levee in horizontal layers not exceeding 12 inches in loose thickness and compacted as indicated.
 - b. Random fill shall be placed to its final position on each side of the select fill concurrent with select fill placement.
 - c. Rocks exceeding the acceptable size shall be either stockpiled or crushed to the acceptable size for use. The acceptable sizes of rocks are shown in the Definitions Section of this specification.
 - 2. Material deposited during canal excavation will have a high moisture content, and shall therefore be dried prior to final incorporation in the levee embankment to obtain suitable moisture content (within plus or minus two percent of optimum moisture density) to permit placement and compaction. Drying may consist of allowing the material to drain for a sufficient period to achieve the necessary moisture content or by mechanical means. Following the drying period, organic and non-organic materials shall be completely mixed.

3. Following mixing, materials shall be placed in the levee above existing grade in horizontal layers not exceeding 12 inches in loose thickness and compacted as shown on the Drawings.
 4. Cohesive soils shall be compacted to not less than 95% of the maximum density at optimum moisture content determined by accordance with ASTM D698. Cohesionless materials shall be compacted to not less than 80% relative density determined in accordance with ASTM D4253 and D4254.
- B. Dam Embankment: The CONTRACTOR shall construct either an earth-filled or rock-filled dam (though both materials can be incorporated into one dam) as determined by various foundation conditions. The CONTRACTOR shall comply with the following:
1. The stability of the upstream and downstream slopes of the dam embankment shall be analyzed for steady-state seepage, pore pressure development during construction, and other critical or severe loading conditions, such as severe weather or rapid drawdown that may occur during the life of the dam.
 2. Field Testing, Laboratory Testing, and Shear Strength tests shall be conducted.
- C. Roadway and Access Berm Embankment: The CONTRACTOR shall construct embankments for roadways and access berms in accordance with the requirements of SECTION 120 of the latest edition of the FDOT Standard Specifications for Road and Bridge Construction.
- D. Non-Water Bearing Embankments: The CONTRACTOR shall construct non-water bearing embankments in accordance with provisions for Levee Embankments except as modified below.
1. Unless required for roadway or access berm embankment, the cohesive material shall be compacted to 85% of the maximum density at optimum moisture content determined by accordance with ASTM D698. Cohesionless materials shall be compacted to not less than 75% relative density determined in accordance with ASTM D4253 and ASTM D4254.
 2. Rock diameter for select fill shall not be more than 3 inches (76 mm) in any direction. The rocks shall be evenly distributed in the embankment and placed to minimize rock to rock contact. This even distribution will permit placement of material without voids and help achieve specified compaction.
- E. Stormwater Treatment Areas (STAs): The CONTRACTOR shall construct STAs with Levee Fill Material.
- F. Final Dressing of Slopes: Following the completion of embankment placement and compaction, the CONTRACTOR shall grade embankment slopes and adjacent transition areas so that they are reasonably smooth and free from irregular surface changes. The CONTRACTOR shall comply with the following:
1. In areas where the embankment is to have grass, sod, or landscaping, the material within the top one foot of the levee, shall be free of any rocks greater than 2 inches (51 mm) in diameter.
 2. The degree of finish shall be that ordinarily obtained from blade grader or similar operations.
 3. Provide roundings at bottom of slopes and other breaks in grade.
- G. Cross-Sections: Provide field measured cross-sections of the final embankments to the DISTRICT for payment and record purposes, plotted at the same stations as the detailed cross-sections shown on the plans, which are not to exceed 500-foot intervals. A tolerance of 0.1 foot on the top of the levee and 0.3 foot on the sides of the levee is permitted. The top of the levee shall have a 2% slope to the interior or as specified by the DISTRICT.

3.04 BACKFILLING:

- A. Pipe Embedment and Backfill: The CONTRACTOR shall perform pipe embedment and backfill as required, shown, and specified in accordance with SECTION 02221 - Trenching, Backfilling and Compacting.
- B. Structure Backfill: The CONTRACTOR shall place structural backfill in accordance with the lines, grades, and cross-sections shown in the Drawings or as ordered by the DISTRICT. The CONTRACTOR shall backfill using select fill. Stones or rocks greater than 2 inches (51 mm) in any dimension shall not be placed within 12 inches of the structure. Lifts shall not exceed 12 inches. The following procedures shall be adhered to:
 - 1. Structure backfill shall be compacted to not less than 95% maximum dry density as measured by ASTM D1557.
 - 2. Backfill shall not be placed against fresh concrete without the approval of the DISTRICT. Once approved, backfill only after concrete has attained at least 70% design strength. Backfill adjacent to structures only after a sufficient portion of the structure has been built to resist the imposed load.
 - 3. Remove all debris from excavation prior to placement of material.
 - 4. Place backfill in level layers of thickness within the compacting ability of equipment used.
 - 5. Perform backfilling simultaneously on all sides of structures. For walls, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.
- C. Unclassified Backfill: The CONTRACTOR shall ensure that unclassified backfill be placed in 12 inch loose lifts to the lines and grades shown on the Drawings or as approved by the DISTRICT. The CONTRACTOR shall compact unclassified backfill to a density approximating the density of surrounding native material and in a manner that will prevent settlement of the completed area.

3.05 MAINTENANCE:

- A. The CONTRACTOR shall protect newly graded areas from actions of the elements.
- B. The CONTRACTOR shall fill, repair, and re-establish grades to the required elevations and slopes for any area that shows settling or erosion occurring prior to seeding.

END OF SECTION

SECTION 02215 PROTECTION OF EXISTING STRUCTURES

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment, and materials for protecting existing structures during construction, and for monitoring and documenting the effectiveness of said protection.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 01320 - Construction Video and Photographs
 - 3. SECTION 02050 - Demolition
 - 4. SECTION 02110 - Clearing and Land Preparation
 - 5. SECTION 02200 - Earthwork
 - 6. SECTION 02221 - Trenching, Backfilling, and Compacting
 - 7. SECTION 02262 - Steel Sheet Piling
 - 8. SECTION 02401 - Dewatering and Cofferdam
 - 9. SECTION 02435 – Turbidity Control and Monitoring

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. All applicable local (City, County, Village, Town, Tribe, etc.) codes, regulations, ordinances, and standards.
 - 2. Florida Department of Transportation (FDOT)
 - a. Standard Specifications for Road and Bridge Construction.

1.03 DEFINITIONS:

- A. Existing Nearby Facilities at Risk (ENFAR): the collective name of any and all nearby buildings, structures, facilities, utilities, property, access roads, levees, ect. located within or adjacent to the Site that could receive seismic motion greater than one-half inch per /second (or a more stringent velocity required by a permit or agency) and could be at risk for being damaged from ground vibrations due to construction.

1.04 SUBMITTALS: The CONTRACTOR shall provide the following Compliance Submittals in accordance with SECTION 01300, which are required:

- A. A complete list of all applicable rules and regulations with which they must comply.
- B. Pre-Construction Condition Survey and Vibration Monitoring and Control:
 - 1. The CONTRACTOR shall submit a Pre-Construction Condition survey in accordance with SECTION 01320, not less than ten (10) days prior to commencing construction operations.

2. The CONTRACTOR shall schedule and conduct a pre-construction condition survey. The CONTRACTOR shall provide one (1) person from its organization and its specialist on vibration control who meets the qualifications of Article 1.05 to organize and lead a team, with the DISTRICT and a representative of each ENFAR, in making a pre-construction condition survey. At a minimum, each ENFAR shall be inspected and its condition documented. The following is a list of each ENFAR specific to this Project for which a pre-construction inspection and report is mandatory whether the ENFAR criteria are met or not:
 - a. The existing structure sheet piling and electrical cabinets to remain shall be undamaged by demolition of the existing gates, gate support structure and concrete pile cap.
 3. A survey method acceptable to the CONTRACTOR's insurance company shall be used. Damage resulting from construction is the CONTRACTOR's responsibility. The CONTRACTOR shall notify the DISTRICT and occupants of nearby buildings at least 24 hours before the start of construction.
 4. Fourteen (14) days before start of construction, the CONTRACTOR shall submit the name and qualifications of the vibration specialist including the following:
 - a. Project names, description, locations, and dates of services performed.
 - b. Name and phone number of owner/agency contact who can verify the experience of the specialist.
 5. The CONTRACTOR shall control vibrations and monitor each operation with approved seismographs and monitoring equipment located at acceptable locations when constructing near buildings, structures, or utilities that may be subject to damage from vibrations. When vibration damage to buildings, structures, or utilities is possible, use seismographs capable of recording particle velocity for three mutually perpendicular components of vibration. The vibration specialist shall interpret the seismograph records to ensure that the data is effectively used in the control of the operations.
- C. The Pre-construction condition survey document shall include at a minimum:
- a. A map of the Project Site with areas of concern highlighted.
 - b. Videotaped or photographically documented existing conditions, and instances of pre-existing cracks or other defects. The documentation shall clearly identify each item. Documentation shall describe the location, the direction from which the photo was taken, and dates. Documentation shall include a narrative of each issue. CONTRACTOR shall note the condition of the existing structures and shall locate and identify any areas where bulging, sloughing, cracking, or existing damage is observed.
 - c. Actual measured horizontal and vertical dimensions (not estimated dimensions) from the nearest operations to surveyed properties, structures, levees, utilities or facilities. The CONTRACTOR is required to have a Professional Land Surveyor registered in the State of Florida supervise the measurements and recording of this information.
 - d. Pertinent diaries or logs of conversations with owners related to the pre-construction condition of the inspected ENFAR's.
 - e. The CONTRACTOR shall clearly document existing conditions.
- D. Seismic Monitoring Records:
1. The records shall be clearly tied to specific construction events and include instrument identification, locations, dates, and times with tabulated and summarized results.
- E. Damage Investigation Survey Document:
1. Within seven (7) calendar days of any WORK event causing damage to any property a survey shall be conducted. Such survey shall include as a minimum:

- a. Detailed description of the damage, including videotape or photographic documentation.
 - b. Name, address and telephone number of the Owner of the damaged property, structures, levees, utilities or facilities. The DISTRICT will supply a master list of adjacent property owner information.
 - c. Evaluation of the cause of the damage and measures taken or to be taken to prevent recurrence.
2. The CONTRACTOR shall supplement this report on a bi-weekly basis (or other time period as determined by the DISTRICT) until the damage is repaired or otherwise made whole.
 3. The CONTRACTOR shall submit an overview of the damage survey results including the status of any damage events, within 30 calendar days of the completion of all construction operations.
- F. Damage Inspection Survey:
1. The CONTRACTOR shall perform Damage Inspection surveys to detect any effects resulting from construction operations.
 2. The CONTRACTOR shall submit Damage Inspection survey, photographs, and other finalized data to the DISTRICT.
 3. The DISTRICT shall inspect the properties, levees, structures, facilities and utilities after receipt of the report to verify the accuracy of the survey. Florida Department of Transportation (FDOT), local electric, gas, or petroleum products transmission utilities, or other property or utility owners may inspect their structures, facilities, levees or utilities. Any damaged areas, which were not specifically identified in the pre-construction survey narrative and photographs, shall be deemed to have been caused by the construction operations. The CONTRACTOR shall be responsible for required repairs at no additional cost to the DISTRICT.

1.05 QUALIFICATIONS:

- A. Vibration Control Specialist. The CONTRACTOR shall utilize a vibration control specialist who is permitted and licensed in the State of Florida with at least five (5) consecutive years of experience in vibration monitoring with at least three (3) projects per year as specified in Article 1.04.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall include in its bid consideration in its progress schedule for time it takes to obtain permits, permit revisions and inspections from the issuing entities.
- B. The CONTRACTOR shall obtain copies of all applicable codes, regulations, laws and ordinances and keep them in its on-site project file.

1.07 CERTIFICATIONS AND TESTING: (Not Used)

1.08 INSPECTION COORDINATION: (Not Used)

PART 2 - PRODUCTS

2.01 MATERIALS ENCOUNTERED:

- A. Materials to be encountered include geologic formations for which the CONTRACTOR has determined appropriate methods for achieving required grades, loosening material, and fragmenting according to gradation requirements. The CONTRACTOR shall ensure in its bid that it has considered all the potential expenses related to the construction required to comply with the industry regulations and with requirements of the plans and specifications.

PART 3 - EXECUTION

3.01 GENERAL:

- A. The CONTRACTOR shall be responsible for any damage to existing properties, utilities, structures, facilities, levees or access roads due to construction activities. The CONTRACTOR shall expediently repair (within 30 days or as approved by the DISTRICT) at no additional expense. Upon the circumstance of damage:
 - 1. The CONTRACTOR shall stop construction operations.
 - 2. The CONTRACTOR shall provide the required damage survey.
 - 3. The CONTRACTOR shall undertake to rectify the damage.
 - 4. The CONTRACTOR shall revise, resubmit, and obtain the DISTRICT's acceptance, and any required third-party acceptance, on the appropriate construction methods before any further WORK is undertaken.
- B. The CONTRACTOR shall have the sole responsibility for the safety of all WORK activities including labor, materials handling, shipment, storage, and equipment.
- C. No time extensions will be made, nor will additional compensation be made for delays or other circumstances related to unacceptable WORK.
- D. The CONTRACTOR shall take precautions to preserve the materials outside the lines of excavation in an undisturbed condition.

3.02 COORDINATION WITH THIRD PARTIES WITH RESPECT TO CONSTRUCTION:

- A. Critical properties, public utilities, levees, structures or facilities may lie close to construction areas associated with this Project. During Project development agreements may have been made between the DISTRICT and relevant third parties. Some of these agreements will guide, restrict and affect the CONTRACTOR's activities. The following list includes the affected parties, and conditions, restrictions, timeframes, issues and consequences that the CONTRACTOR must consider in his bid for both costs and scheduling. The CONTRACTOR shall be responsible for plan implementation and effectiveness while accommodating such agreements. There will be no extra compensation for activities the CONTRACTOR must pursue to satisfy the conditions.
 - 1. **Maintain communication of construction activities so that the DISTRICT can keep the adjacent property owner (9415 E Sandpiper Dr, Inverness, FL 34450) informed.**

3.03 TURBIDITY AND EROSION CONTROL:

- A. The CONTRACTOR shall install turbidity and erosion control devices in accordance with SECTION 02435 prior to start of construction.

3.04 SITE PREPARATION:

- A. The CONTRACTOR shall demolish structures and other items as shown on the Drawing and in accordance with SECTION 02050.
- B. The CONTRACTOR shall clear the Site in accordance with SECTION 02110.
- C. The CONTRACTOR shall strip the Site in accordance SECTION 02200.
- D. Vibration Control: The CONTRACTOR shall provide a minimum of three (3) seismographs sufficient to measure and record ground movements caused by construction. The seismographs shall be placed at locations to include, but not limited to, the nearest properties, buildings, structures, levees, or utilities, and such locations are to be approved by the DISTRICT:

1. Seismograph operators shall be qualified personnel capable of setting up instruments at designated locations and efficiently recording the construction. Construction shall be controlled in such a manner that the maximum ground vibration level at any structure which is vulnerable to damage shall not exceed a zero-to-peak particle velocity of one-half inch per /second or any more stringent permit or regulatory agency requirement.
2. The instrumentation shall record three (3) orthogonal components (vertical, radial, and transverse with respect to the location of the construction) of particle velocity direct (or shall have sufficient resolution of acceleration or displacement such that particle velocity can be readily and accurately determined from the records). The instantaneous vector sum of the three (3) directional components of vibration will be used to compute the maximum vibration level. A written memorandum of vibration intensity shall be submitted within 24 hours when specifically requested by the DISTRICT, or without request when such intensity exceeds a peak particle velocity of one and one-half inch per second.

END OF SECTION

SECTION 02220 EXCAVATION AND BACKFILLING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials, and equipment to perform the excavation and backfilling as shown on the Drawings.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 02110 Clearing and Land Preparation
 - 2. SECTION 02221 Trenching, Backfilling & Compaction
 - 3. SECTION 02401 Dewatering
 - 4. SECTION 02262 Steel Sheet Piling
 - 5. SECTION 02200 Earthwork

1.02 APPLICABLE PUBLICATIONS:

- A. American Society of Testing Materials (ASTM)
 - 1. D698 Standard Test Methods for Laboratory compaction Characteristics of Soil Using the Standard Effort (56,000 ft-lbf/cu. ft.)
 - 2. D1557 Standard Test Methods for Laboratory compaction Characteristics of Soil Using the Modified Effort (12,400 ft-lbf/cu. ft.)
 - 3. D4253 Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
 - 4. D4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- B. Florida Department of Transportation
 - 1. Standard Specifications for Road and Bridge Construction, latest edition, (FDOT)
- C. Miscellaneous Project Data:
 - 1. Report of Geotechnical Engineering Services (for Tsala Apopka Golf Course Structure Modification), Tierra, Inc., September 21, 2018.

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: The CONTRACTOR shall submit, prior to the start of work, the planned method of construction of the embankments shown on the Drawings, or as specified herein, for the DISTRICT'S review. This plan shall also indicate the intended construction sequence for backfilling operation.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS AND TESTING: Field density tests in accordance with ASTM Standards, for each type of material used in backfilling may be required. Failure to meet the specified density will require the CONTRACTOR to recompact and retest, at its own expense, those areas requested by the DISTRICT.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide the District at least 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS, and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard

warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.

- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

- 2.01 STRUCTURAL BACKFILL: The CONTRACTOR shall provide satisfactory structural backfill material which shall consist of material free of muck, stumps, rocks, or other material considered unacceptable by the DISTRICT. The use of recycled concrete materials for backfilling of culverts or water control structures is prohibited. The general requirements for fill shall be in accordance with SECTION 02200 Earthwork and FDOT 120-7.1 and 7.2.
- 2.02 EMBANKMENT FILL: The CONTRACTOR shall provide embankment fill free of muck, stumps, roots, brush, vegetation or other material considered undesirable by the DISTRICT. The general requirements of embankment fill shall be in accordance with SECTION 02200 Earthwork and FDOT 120-7.1 and 7.2.

PART 3 - EXECUTION

3.01 SITE PREPARATION:

- A. Clearing and Grubbing: The CONTRACTOR shall perform clearing and grubbing in accordance with SECTION 02110 Clearing and Land Preparation and with the following provisions:
1. Perform only in areas where earthwork or other construction operations are to be performed or otherwise shown on Drawings.
 2. Protect tops, trunks, and roots of existing trees that are to remain on the site.
 3. Clear areas and dispose of other trees, brush and vegetation before starting construction.
 4. Remove tree stumps and roots larger than three inches in diameter and backfill resulting excavations with approved material.
- B. Stripping: The CONTRACTOR shall remove topsoil from areas within limits of excavation and areas designated to receive compaction as shown on the Drawings, required and as provided below:
1. Scrape area clean of all brush, grass, weeds, roots, and other material.
 2. Strip to depth of approximately six inches or to a sufficient depth to remove excessive roots in heavy vegetation or brush areas and as required segregating topsoil.
 3. Stockpile topsoil in areas where it will not interfere with construction operations or existing facilities. Stockpiled topsoil shall be reasonably free of subsoil, debris and stones larger than two inches in diameter.

- 3.02 DISPOSAL OF SURPLUS AND UNSUITABLE MATERIAL: The CONTRACTOR shall dispose of all excess or unsuitable material off-site or in areas otherwise approved by the DISTRICT.

- 3.03 STOCKPILE OF EXCAVATED MATERIAL: The CONTRACTOR shall stockpile excavated materials in areas shown on the Drawings or in areas otherwise approved by the DISTRICT.

- 3.04 PLACEMENT OF STRUCTURAL FILL: The CONTRACTOR shall place structural backfill true to the lines, grades and, cross sections shown in the Drawings or as ordered by the DISTRICT. Structural backfill shall be deposited by the CONTRACTOR in horizontal layers not exceeding eight inches in depth measured loose, and shall be compacted to a density of not less than 95 percent of the maximum density at optimum soil moisture content +/- 2% as determined by ASTM D1557 Standards. Backfill shall not be placed against fresh concrete without the approval of the DISTRICT.

- 3.05 PLACEMENT OF EMBANKMENT FILL: The CONTRACTOR shall construct embankments true to the lines, grades, and cross sections shown on the Drawings. Fill for embankments shall be placed by the CONTRACTOR in successive layers of not more than twelve inches in thickness, measured loose, for the full width of the embankment. Each layer of the material used in the formation of the embankments shall be

compacted by the CONTRACTOR to a density of at least 95 percent of the maximum density as determined by ASTM D1557 Standards. Unreasonable roughness of the surface shall be dressed out. Rocks and boulders shall not project above the finished surfaces. All areas disturbed shall be graded by the CONTRACTOR so that water drains freely at all points after construction.

- 3.06 COMPACTION EQUIPMENT: When placing fill adjacent to foundations or retaining walls, heavy equipment for spreading and compacting fill shall not be operated closer than a distance equal to the height of backfill above the top of the footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the materials being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.
- 3.07 GRADING: The CONTRACTOR shall perform grading as shown on the Drawings, required, and provided for below:
- A. Grade and compact all areas within the project area, including excavated and filled sections and adjacent transition areas, reasonably smooth, and free from irregular surface changes.
 - B. Degree of finish shall be that ordinarily obtained from blade grader or scraper operations except as otherwise specified.
 - C. Finished rough grades shall generally be not more than one quarter foot above or below those indicated with due allowances for topsoil.
 - D. Finish all ditches, swales, and gutters to drain readily.
 - E. Provide roundings at top and bottom of banks and at other breaks in grade.
- 3.08 CLEANUP: The CONTRACTOR shall cleanup the site as required and provided for below, to the satisfaction of the District:
- A. Clear surfaces of all stones, roots, grading stakes, and other objectionable materials.
 - B. Keep paved areas clean and promptly remove rock or dirt dropped upon surfaces.
- 3.09 PROTECTION AND MAINTENANCE: The CONTRACTOR shall maintain the embankments until final acceptance of all work. The maintenance shall include repairs of any erosion, slides, or other damages.

END OF SECTION

SECTION 02240 SOIL STABILIZATION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment, and materials for stabilization of the soil to provide a firm and unyielding subgrade for the WORK as described in this SECTION.

1. SECTION 02200 - Earthwork

1.02 APPLICABLE PUBLICATIONS: The following standard specifications shall apply to the WORK of this SECTION as indicated:

- A. Florida Department of Transportation

1. Standard Specifications for Road and Bridge Construction, latest edition, (FDOT)

- B. American Society of Testing Materials, (ASTM)

1. ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Modified Effort (56,000 ft-lb/ft³ (2,700 kN-m/m³))
2. ASTM D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by the Nuclear Methods (Shallow Depth)

- C. Soils Report/Boring log, See Appendix

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: (Not Applicable)

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS AND TESTING: The CONTRACTOR shall provide to the DISTRICT three (3) copies of certified test results for the tests required to be performed by the CONTRACTOR.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities. The DISTRICT may perform field density tests in accordance with ASTM Standards, for each type of material used in backfilling. Failure to meet the specified density will require the CONTRACTOR to recompact and retest, at its own expense, those areas requested by the DISTRICT.

- A. Soils Report/Boring log, See Appendix/Drawings.

1. Report of Geotechnical Engineering Services (for Tsala Apopka Golf Course Structure Modification), Tierra, Inc., September 21, 2018.

1.09 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS:

- A. General Requirements: The CONTRACTOR shall provide the required stabilization material which shall be either commercial limerock or crushed shellrock in conformance with FDOT Standard Specifications for Road and Bridge Construction Section 914-3, Type B Stabilizing.

PART 3 - EXECUTION

- 3.01 PREPARATION: The CONTRACTOR, prior to beginning the stabilizing operations, shall grade the area to be stabilized to an elevation such that upon completion of the stabilizing operations the stabilized subgrade will conform to the lines, grades and cross sections shown on the Drawings.
- 3.02 APPLICATION OF STABILIZING MATERIAL: The CONTRACTOR shall spread the stabilizing material uniformly over the area to be stabilized. The CONTRACTOR shall then mix the material with rotary tillers, or other equipment meeting the approval of the DISTRICT. The area to be stabilized shall be thoroughly mixed throughout the entire depth and width of the stabilizing area.
- 3.03 COMPACTION: After mixing operations are completed, the CONTRACTOR shall compact the area to the minimum density as required by FDOT Section 160-8. The subgrade shall be firm and unyielding; to the extent that it will support construction equipment. The CONTRACTOR shall remove all soft and yielding material, and any other portions of the subgrade, which will not compact readily, and replace with suitable material and the whole subgrade brought to line and grade.
- 3.04 FINISH GRADING: The CONTRACTOR shall shape the completed stabilized subgrade to conform to the finished lines, grades, and cross-sections indicated on the Drawings.
- 3.05 MAINTENANCE: After the subgrade has been completed as specified, the CONTRACTOR shall maintain it free from, ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, etc. It shall be the CONTRACTOR's responsibility to maintain the required density until the subsequent base is in place.

END OF SECTION

SECTION 02370 RIPRAP SYSTEM

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish stone riprap, bedding stone and filter fabric for construction of channel lining where indicated.

1.02 RELATED WORK REFERENCED ELSEWHERE:

- A. SECTION 01300 - Submittals

1.03 APPLICABLE PUBLICATIONS: The following standard specification shall apply to the WORK of this SECTION:

- A. American Society for Testing and Materials (ASTM):
 - 1. C127 - Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Course Aggregate
 - 2. C535 - Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- B. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. T 85 Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
 - 2. T 120 Method of Test for Aggregate Durability Index
- C. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, (FDOT)

1.04 DEFINITIONS: (Not Used)

1.05 SUBMITTALS: Furnish submittals in accordance with SECTION 01300 Contractor Submittals. The CONTRACTOR shall furnish to the DISTRICT, testing certificates from a qualified independent testing laboratory prior to acceptance of the rock source to verify the conformity to the requirements of the Contract Documents.

1.06 QUALIFICATIONS: (Not Used)

1.07 RESPONSIBILITIES: (Not Used)

1.08 CERTIFICATIONS:

- A. Test Reports: The CONTRACTOR's rubble riprap supplier shall submit certified test reports prepared by a qualified independent testing laboratory selected and compensated by CONTRACTOR for the tests required in Article 2.01 B of this SECTION. The table shown below specifies the minimum number of tests for each Project to establish quality control during the processing of a single 2,500-ton stockpile.

| Test Required | Number of Tests | Test Method |
|------------------|-----------------|------------------------|
| Specific Gravity | 2 | ASTM C127 |
| Absorption | 2 | ASTM C127, AASHTO T 85 |
| Soundness | 2 | ASTM C88 |

| Test Required | Number of Tests | Test Method |
|------------------|-----------------|--------------|
| Durability Index | 2 | AASHTO T 210 |
| L.A. Abrasion | 2 | FM 3-C 535 |
| Gradation | 1 | FM 5-538 |

B. Filter Fabric: The CONTRACTOR shall submit MANUFACTURER's data for filter fabric demonstrating compliance with specified material properties, and including MANUFACTURER's recommendations for storage, handling, installation, and anchoring fabric.

1.09 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide the DISTRICT 48 hours advance notice of its intention to begin new WORK activities.

1.10 WARRANTY:

- A. The MANUFACTURER shall warrant the MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER's standard warranty, but for no less than one (1) year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - MATERIALS

2.01 RIPRAP: The CONTRACTOR shall furnish stone for riprap that shall be sound, durable and angular in shape. No more than 10% of the stone for any gradation shall have an elongation (ratio of greatest dimension to least dimension) greater than 3:1, and no stone shall have an elongation greater than 4:1. The riprap material shall be provided by a Florida Department of Transportation (FDOT) certified pit or from onsite excavations and conform to the following additional requirements.

- A. Material shall be free from cracks, seams, non- mineralized or other defects that would tend to increase its deterioration from natural causes. Riprap shall consist of dense, natural rock fragments. Stones shall be resistant to weathering and to water action; free from overburden, spoil, shale and organic material; and shall meet the gradation requirements below. Shale and stones with shale seams are not acceptable.
- B. Stone for riprap shall have the following properties:
1. Bulk specific gravity (saturated surface-dry basis) not less than 2.38 when tested by ASTM C127 for gradations A, B, and C, and D.
 2. The minimum apparent specific gravity of the stones shall be 2.5 as determined by AASHTO T 85.
 3. Absorption of not more than 5.0% when tested by ASTM C127.
 4. Soundness: Soundness of stone shall be determined in accordance with ASTM C88, modified as specified herein. Weight loss in 5 cycles shall be not more than 10% when sodium sulfate is used or 15% when magnesium sulfate is used.
 5. Stones shall consist of durable, sound, hard, angular rock meeting the following requirements for durability absorption ratio, soundness test, and abrasion test:

Durability Absorption Ratio

Greater than 23

Acceptability

Passes

10 to 23
Less than 10

Passes only if Durability Index is 52 or greater

Fails

$$\text{Durability Absorption Ratio} = \frac{\text{Durability Index (Coarse)}}{\% \text{ absorption} + 1}$$

6. The durability index and percent absorption shall be determined by AASHTO T 210 and AASHTO T 85, respectively. The minimum apparent specific gravity of the stones shall be 2.5 as determined by AASHTO T 85.
7. Stones shall have less than ten (10) percent loss of weight after five cycles, when tested per ASTM C88.
8. Stones shall have a wear not greater than 40 percent, when tested per ASTM C535.
9. Stone gradation based on a representative sample of not less than 2.0 cubic yards. Each stone in the sample shall be individually weighed, and a cumulative plot of percent lighter (by weight) versus stone weight in pounds shall be submitted.

C. The riprap shall be graded as follows:

1. Use Type C (12-inch Average Size) Riprap as specified herein.

| Type A (6-inch Average Size) | | |
|-------------------------------------|----------------|--------------------------------------|
| Sieve Size | | Percent Passing by Weight |
| Maximum | Minimum | |
| 12" | 9" | 100 |
| 8" | 7" | 50 |
| 6" | 5" | 15 |

| Type B (12-inch Average Size) | | |
|--------------------------------------|----------------|--------------------------------------|
| Sieve Size | | Percent Passing by Weight |
| Maximum | Minimum | |
| 21" | 15" | 100 |
| 14" | 12" | 50 |
| 11" | 8" | 15 |

| Type C (18-inch Average Size) | | |
|--------------------------------------|----------------|--------------------------------------|
| Sieve Size | | Percent Passing by Weight |
| Maximum | Minimum | |
| 30" | 22" | 100 |
| 20" | 18" | 50 |
| 16" | 12" | 15 |

| Type D (24-inch Average Size) | | |
|--------------------------------------|----------------|--------------------------------------|
| Sieve Size | | Percent Passing by Weight |
| Maximum | Minimum | |
| 42" | 31" | 100 |
| 28" | 24" | 50 |
| 22" | 17" | 15 |

- D. Control of gradation shall be by visual inspection. The CONTRACTOR shall furnish a sample of the proposed gradation of at least five (5) tons or ten (10) percent of the total riprap weight, whichever is less. If approved, the sample may be incorporated into the finished riprap at a location where it can be

used as a frequent reference for judging the gradation of the remainder of riprap. Any difference of opinion between the DISTRICT and the CONTRACTOR shall be resolved by dumping and checking the gradation of two random truckloads of stones. Arranging for and the costs of mechanical equipment, a sorting site, and labor needed in checking gradation shall be the CONTRACTOR's responsibility.

E. The acceptability of the stones will be determined by the DISTRICT prior to placement.

2.02 **GRANULAR BEDDING:** The CONTRACTOR shall place a blanket of bedding material beneath the riprap materials to the lines and grades shown on the drawings. Stone for use in granular bedding shall weigh not less than 135 lbs/cf (saturated surface dry). The material shall be composed of tough, durable particles, shall be reasonably free from thin, flat and elongated pieces, and shall contain neither organic matter nor soft, friable particles in quantities considered objectionable by the DISTRICT. Bedding stone shall be placed within the limits shown on the drawings and shall be reasonably well graded in accordance with FDOT Section 901, Standard Specifications for Road and Bridge Construction, latest edition. The bedding stone for each type of riprap shall be as follows:

| Type of Riprap | Bedding Stone |
|----------------|-----------------------|
| Type A | ASTM C33 Size No. 57 |
| Type B | ASTM C33 Size No. 357 |
| Type C | ASTM C33 Size No. 2 |
| Type D | ASTM C33 Size No. 1 |

2.03 **FILTER FABRIC:** The CONTRACTOR shall provide geotextile (filter) fabric conforming to the requirements of FDOT Section 985 for drainage applications.

2.04 **TEMPORARY RIPRAP:** The CONTRACTOR shall furnish temporary riprap as indicated on the Drawings conforming to the requirements of Part 2 of this SECTION for Gradation B.

PART 3 - PERFORMANCE

3.01 **FIELD QUALITY CONTROL:**

- A. The CONTRACTOR shall recombine the riprap stone sample used for gradation analysis, transport to the Project Site, and place in a location acceptable to the DISTRICT. Field control of riprap gradation will be by visual comparison of the representative sample to arriving loads. Arriving loads not bearing reasonable similarity to the sample will be rejected.
 - 1. CONTRACTOR may, at his option, arrange for gradation analysis of rejected loads at the Project Site. Should the analysis indicate the rejected stone meets the requirements of this SECTION; all reasonable costs for such analysis will be reimbursed to the CONTRACTOR. In no instance will stone of a coloration or appearance dissimilar to that in the sample be accepted.

3.02 **SUBGRADE PREPARATION:**

- A. Dry Installation: The CONTRACTOR shall prepare the subgrade to the lines, slopes and elevations indicated. The CONTRACTOR shall clear the subgrade of sticks, stones, debris and other materials that could puncture the overlying filter fabric. The finished subgrade shall not vary from design grade by more than 2" at any location.

- B. Sub aqueous Installation: The CONTRACTOR shall excavate the subgrade to the lines and grades shown. Tolerance shall be plus 0.0 feet to minus 0.5 feet in the canal invert, and plus or minus 0.5 feet on the Canal banks.
- 3.03 FILTER FABRIC: The CONTRACTOR shall provide filter fabric in accordance with the requirements of FDOT Section 514. Filter fabric shall be placed only on subgrade approved by the DISTRICT.
- 3.04 GRANULAR BEDDING: The CONTRACTOR shall place bedding material beneath the riprap, to a nominal depth of six (6) inches.
- A. Bedding material shall be spread uniformly over filter fabric material. Placement shall not commence until the DISTRICT has approved subgrade preparation and filter fabric installation.
- B. Placement methods, which segregate the bedding particles, will not be permitted.
- C. Compaction of the bedding material will not be required, but material shall be finished to a reasonably even surface.
- D. Tolerance shall be + three-tenths foot provided this tolerance is not continuous over an area greater than 200 square feet when placed in the dry, or greater than 400 square feet when placed sub aqueous.
- E. CONTRACTOR shall maintain the bedding material until the riprap is in place.
- 3.05 RIPRAP: The CONTRACTOR shall proceed placing the riprap upon completion of filter fabric and bedding material (where required) and after receiving approval of the DISTRICT to proceed. The CONTRACTOR shall place riprap in accordance with the following.
- A. Stone shall be placed in such a manner as to produce a reasonably well-graded mass with the minimum practicable percentage of voids.
1. Place to full course thickness in one operation in a manner to avoid displacing or puncturing filter fabric.
- a. Stone shall not be dropped from a height greater than three (3) feet above the fabric.
2. Finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Hand place or adjust if necessary to secure the desired results.
- B. Surface Tolerances:
1. Dry Installation: The finished stone surface shall not vary from design grade by more than three (3) inches at any location, except that any extreme of the tolerance shall not be continuous over an area greater than 100 square feet.
2. Sub aqueous Installation: The finished stone surface shall not vary from design grade by more than plus one foot, minus one-half feet at any location; either extreme of the tolerance shall not be continuous over an area greater than 225 square feet.
- 3.06 MAINTENANCE: The CONTRACTOR shall maintain the riprap until accepted by the DISTRICT. The CONTRACTOR shall replace riprap displaced by any cause prior to acceptance.

END OF SECTION

SECTION 02401 DEWATERING AND COFFERDAM

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary or Work: The CONTRACTOR shall furnish all labor, material and equipment necessary for the removal of all surface and subsurface waters from excavation areas. This SECTION includes the construction of a wellpoint system used in conjunction with an open excavation or cofferdam, temporary cofferdams with steel sheet piling and bracing, or other systems as proposed by the CONTRACTOR. The WORK includes the removal of temporary sheet piling and other temporary features at the completion of the WORK.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 01530 – Temporary Barriers and Controls
 - 3. SECTION 02262 - Steel Sheet Piling
 - 4. SECTION 02435 – Turbidity Control and Monitoring

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society for Testing and Materials (ASTM):
 - a. A36 - Standard Specification for Carbon Structural Steel
 - b. A328 - Standard Specification for Steel Sheet Piling
- B. Report of Geotechnical Engineering Services (for Tsala Apopka Golf Course Structure Modification), Tierra, Inc., September 21, 2018.

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS: The CONTRACTOR shall make submittals in accordance with SECTION 01300 and the following:

- A. The CONTRACTOR shall submit to the DISTRICT a site-specific dewatering plan for regulatory approval, which includes qualifications of the design professional(s), the dewatering system and temporary cofferdam design, dewatering equipment, safety procedures, sequence of construction, and re-watering procedures, prior to the start of any such operations. The dewatering plans shall also include the items specified in Article 1.06 of this SECTION.
- B. Submit certification from a Professional Engineer registered in the State of Florida that the temporary cofferdam has been designed to meet the criteria specified herein.
- C. Two (2) sets of signed and sealed prints of the temporary cofferdam system shall be submitted to the DISTRICT.
- D. Acquire all permits required to discharge water and protect waterways from turbidity during the dewatering operation.

1.05 QUALIFICATIONS:

- A. The CONTRACTOR shall demonstrate a minimum of ten (10) years experience in the construction of dewatering systems including, but not necessarily limited to, sheet pile, pumping and cofferdams.
- B. Qualifications of the dewatering system design engineer must demonstrate a minimum of ten (10) years experience doing similar work as approved by the DISTRICT and be a Professional Engineer registered in the State of Florida.

1.06 RESPONSIBILITIES:

- A. This is a performance specification. Except as otherwise specified or indicated, selection of equipment, materials, and methods shall be CONTRACTOR's responsibility. The dewatering of any excavation areas and disposal of all water handled shall be in strict accordance with all local and state government rules and regulations.
- B. The CONTRACTOR shall be responsible for the design of the dewatering system including, but not necessarily limited to, the temporary cofferdam, required pump equipment, temporary shoring, as well as any miscellaneous temporary structures required.
- C. The dewatering plan shall include at a minimum:
 - 1. A site plan of the Project indicating the location of the proposed discharge point(s) with the associated water quality monitoring locations including background and compliance turbidity monitoring locations, the location and type of erosion and turbidity control devices, and the methods necessary to ensure that the state water quality standards are met.
 - 2. Calculations for estimating the area of influence of dewatering, depth of dewatering, pumping rates, duration and volumes, and the proposed method of dewatering must be submitted for review.
 - 3. A water quality monitoring plan.
- D. Unless otherwise specified, the dewatering systems shall lower the groundwater table to a minimum of two (2) feet below the excavation. The dewatering plan shall include installation of a minimum of two (2) groundwater monitoring wells located on opposite sides of the excavation.
- E. Volume of water discharged must be reported at each Site. The CONTRACTOR shall submit, calibration data, operating ranges of the pumping equipment, and instrumentation to be used to determine flows and daily volumes pumped.
- F. If it is anticipated that offsite discharges will occur due to construction dewatering activities, the CONTRACTOR must also include documentation that the dewatering activities will meet the criteria contained in the "Basis of Review for Water Use Permit Applications within the Southwest Florida Water Management District" - latest edition, with emphasis on the reasonable assurances requirements for on-site retention of dewatering water in Section 2.5.2.
- G. The CONTRACTOR shall comply with the following conditions of the National Pollutant Discharge Eliminating System (NPDES) Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity.
 - 1. The facility is authorized to discharge produced ground water from any non-contaminated site activity which discharges by a point source to surface waters of the State, as defined in Chapter 62-620, Florida Administrative Code (F.A.C.), ONLY if the reported values for the parameters listed in Table 1 do not exceed any of the listed screening values. Before discharge of produced ground water can occur from such sites, analytical tests on samples of the proposed untreated discharge water shall be performed to determine if contamination exists.
 - 2. Minimum reporting requirements for all produced ground water dischargers: The effluent shall be sampled before the commencement of discharge, again within 30 days after commencement of discharge, and then once every six (6) months for the life of the Project to maintain continued coverage under this generic permit. Samples taken in compliance with the provisions of this permit shall be taken prior to actual discharge or mixing with the receiving waters. The effluent shall be sampled for the parameters listed in Table 1. In addition, equipment blanks will be required and monitoring using an autosampler may be required.

Table 1

| Parameter | Screening Values for Discharges into: | |
|----------------------------|---------------------------------------|----------------|
| | Fresh Waters | Coastal Waters |
| Total Organic Carbon (TOC) | 10.0 mg/l | 10.0 mg/l |

| Parameter | Screening Values for Discharges into: | |
|-----------------------------------|---------------------------------------|----------------|
| | Fresh Waters | Coastal Waters |
| pH, standard units | 6.0-8.5 | 6.5-8.5 |
| Total Recoverable Mercury | 0.012 µg/l | 0.025 µg/l |
| Total Recoverable Cadmium | 9.3 µg/l | 9.3 µg/l |
| Total Recoverable Copper | 2.9 µg/l | 2.9 µg/l |
| Total Recoverable Lead | 0.03 mg/l | 5.6 µg/l |
| Total Recoverable Zinc | 86.0 µg/l | 86.0 µg/l |
| Total Recoverable Chromium (Hex.) | 11.0 µg/l | 50.0 µg/l |
| Benzene | 1.0 µg/l | 1.0 µg/l |
| Naphthalene | 100.0 µg/l | 100.0 µg/l |

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1.07 CERTIFICATIONS AND TESTING:

- A. A Professional Engineer registered in the State of Florida hired by the CONTRACTOR shall inspect, accept, and certify the temporary sheet piling used for dewatering purposes.

1.08 INSPECTION COORDINATION:

- A. The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The Contractor shall provide at least 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: (Not Used)

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS:

- A. All materials used in the construction of the dewatering facilities shall be selected, furnished and installed by the CONTRACTOR in accordance with the design as submitted to the DISTRICT.

2.02 SHEET PILE:

- A. The CONTRACTOR shall provide new or used temporary sheet piling for use in the cofferdam conforming to the requirements of ASTM A328.

2.03 STRUCTURAL STEEL:

- A. The CONTRACTOR shall provide structural steel for use in the cofferdam conforming to the requirements of ASTM A36.

PART 3 - EXECUTION

3.01 PERFORMANCE: The CONTRACTOR shall furnish and install sheet pile cofferdams in accordance with the following.

- A. The CONTRACTOR shall retain the services of a Professional Engineer registered in the State of Florida for the design of the cofferdam system. The walls and bracing shall be designed to withstand, without damage, the maximum water elevations indicated in the Regulation Schedule below (Paragraph 3.05). Bracing will not be allowed to impart loads to the permanent structure. Temporary construction loads to the permanent structure in excess of those imparted during in-situ operating conditions will not be allowed. It should be noted that the sheet pile wing walls are supported by anchor rods connected to anchor walls, concrete deadmen, pilings, etc., so installation of a cofferdam shall be phased to avoid interfering with these elements or otherwise reducing their load-carrying capacity.

- B. Approximate locations of cofferdam, structural characteristics and embedment depths shall be determined by the engineer designing the cofferdam. It should be noted that steel sheet pile cutoff walls and wing walls are a part of the permanent features to be constructed both within and outside the dewatered areas. If a sheet pile cofferdam is proposed, the CONTRACTOR shall provide a sequence of construction that complies with the requirement of SECTION 02262 and does not affect the integrity of the permanent components.
- C. The layout and design of the interior and exterior bracing system for the cofferdam shall fully accommodate with appropriate factors of safety, all applied loading indicated. Those loadings may be increased if considered appropriate by the engineer designing the cofferdam.

3.02 DEWATERING:

- A. The CONTRACTOR shall provide adequate equipment for removal of storm, subsurface or cofferdam leakage waters, which may accumulate in the cofferdam interior.
- B. The CONTRACTOR shall perform all WORK for the water control structure in the cofferdam interior free from water. The CONTRACTOR shall furnish, install, maintain, and operate all necessary pumping and other equipment necessary for dewatering the WORK area.
 - 1. All dewatering equipment shall be in first-class condition and shall at all times be maintained and operated at the efficiency and capacity necessary for maintaining the cofferdam interior free from standing water or wet conditions that may prevent proper construction.
- C. The CONTRACTOR shall provide dewatering facilities with stand-by pumps with 100 percent standby capacity.
- D. The CONTRACTOR shall comply with all local, state and federal regulations when disposing of water generated by dewatering operations.

3.03 TURBIDITY BARRIER:

- A. The CONTRACTOR shall install and maintain suitable turbidity barriers as described in SECTIONs 01530 and 02435.

3.04 REMOVAL OF DEWATERING SYSTEM AND COFFERDAMS:

- A. The CONTRACTOR shall remove the dewatering system in such a manner as to allow groundwater and surface water elevations to slowly return to natural elevations without causing erosion or damage to the structure or foundation.
- B. The CONTRACTOR shall slowly flood the dewatered area to establish water surface elevations upstream of water control structure and equal to tailwater downstream of water control structure prior to removal of temporary cofferdams.
- C. If a portion of the cofferdam is incorporated into the structure, the CONTRACTOR shall review the Drawings to determine what portion of the sheet pile of the cofferdam that shall be removed.

3.05 REGULATION SCHEDULE:

- A. Canal Water Levels:
 - 1. The DISTRICT operates the existing structure to maintain, in as much as practical the following canal elevations:

| Location | High Guidance Levels |
|-----------------------------|----------------------|
| Upstream (Floral City Pool) | 40.95 NAVD 88 |
| Downstream (Inverness Pool) | 39.45 NAVD 88 |

- B. Noise Abatement: The CONTRACTOR shall furnish, install, and maintain throughout the course of the WORK, mufflers, noise-control enclosures, or other noise control methods, measures, and features on and around all dewatering pumps and their drive units such that steady noise emanating from this equipment does not exceed the permissible sound levels defined in the local County ordinances.

END OF SECTION

SECTION 02435 TURBIDITY CONTROL AND MONITORING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all necessary equipment, labor and materials and utilize appropriate means and methods of turbidity controls necessary and sufficient to ensure that the more restrictive and protective of the following are achieved at all times: (1) all applicable State water quality standards, as prescribed in Chapter 62-302.530, Florida Administrative Code (F.A.C.), incorporated by reference, (2) all applicable environmental permit conditions, as prescribed in the permits appended to the Contract, and (3) all stormwater and erosion control shall be in accordance with the Florida Department of Environmental Protection (FDEP) Florida Stormwater Erosion and Sedimentation Control Inspector's Manual, current edition.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. SECTION 01300 - Submittals

1.03 APPLICABLE PUBLICATIONS: The environmental protection rules and standards in the applicable sections of the Florida Administrative Code (F.A.C.) incorporated herein by reference are:

- A. <http://www.dep.state.fl.us/legal/Rules/rulelistnum.htm>.
- B. Design and Performance Standards - 62-25.025 F.A.C.
- C. Quality Assurance - 62-160 F.A.C.
- D. Surface Waters of the State - 62-301 F.A.C.
- E. Surface Water Quality Standards - 62-302 F.A.C.
- F. Generic Permits - 62-621.300(2)&(4) F.A.C.

1.03 DEFINITIONS: (Not used)

1.04 SUBMITTALS: The CONTRACTOR shall make submittals for the turbidity control and monitoring system in accordance with SECTION 01300 and the requirements herein.

- A. Provide details of the turbidity controls proposed.
- B. Provide proposed layout of turbidity controls and monitoring system on the site plan.
- C. Obtain monitoring data and prepare quarterly reports in accordance with Paragraph 3.03B.

1.05 QUALIFICATIONS: The CONTRACTOR shall have on-site at least one (1) employee certified by the Florida Department of Environmental Protection as a Stormwater Erosion and Sedimentation Control inspector. The certification shall be submitted to the DISTRICT for review prior to the installation, inspection, maintenance, repair or replacement of any erosion or sedimentation control Best Management Practices, including but not limited to turbidity controls. The turbidity monitoring shall be conducted according to FDEP-approved procedures.

1.06 RESPONSIBILITIES: (Not Used)

1.07 CERTIFICATIONS AND TESTING: (Not Used)

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the

DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: (Not Used)

PART 2 - PRODUCTS

2.01 FABRIC: The CONTRACTOR shall provide fabric that is flexible and impermeable or of sufficiently fine mesh to prevent passage of suspended material through the fabric. Fabric shall provide not less than 60 inches vertical depth of barrier where existing water depths are six feet or greater. Where existing water depths are less than six feet, the fabric depth may be decreased in 12-inch increments to not less than 12 inches to conform to existing bottom depths.

2.02 FLOATS: The CONTRACTOR shall provide floats for barriers of sufficient buoyancy to prevent the top of the barrier from submerging under any water and wind conditions. If the top of the barrier becomes submerged for any reason, the CONTRACTOR shall suspend construction operations until the condition is corrected.

2.03 ANCHORS AND WEIGHTS: The CONTRACTOR shall provide and maintain an anchor system to secure the barrier in position. Attach weights to the barrier as necessary to keep the fabric at an angle to the vertical of 30 degrees or less. Fabric material shall not be attached to the canal bottom.

PART 3 - EXECUTION

3.01 TURBIDITY BARRIERS:

A. The CONTRACTOR shall install and maintain turbidity barriers as noted in the drawings and where necessary to maintain turbidity releases at or below permit compliance levels. Barriers shall be installed prior to any backfilling, clearing and grubbing, dredging, or excavation and maintained in place until construction is complete and turbidity from construction has dissipated. All barriers shall be adequately marked and appropriate signage erected to identify them as obstructions to navigation.

B. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

The applicable U.S. Army Corps of Engineers in-water work protection guidelines for the endangered West Indian Manatee incorporated herein by reference are:

<http://www.saj.usace.army.mil/Divisions/Regulatory/sourcebook/25-EndangeredSpecies.html>

C. Any rips or tears that occur in the turbidity barrier material during use shall be repaired or replaced immediately by the CONTRACTOR at its expense. Rips or tears that occur in the turbidity barrier material in use that are not repaired or replaced immediately by the CONTRACTOR will result in a suspension of excavation and/or construction operations, and shall require repairs and replacements as a prerequisite to the resumption of work.

D. The CONTRACTOR shall keep in place and maintain all barriers until the WORK is complete (construction areas stabilized with vegetation) and turbidity levels return to background levels based on monitoring results. Upon completion of use, the CONTRACTOR shall remove the turbidity barriers and associated items to an off-site location at its own expense.

E. The CONTRACTOR shall conduct its operations at all times in a manner that minimizes turbidity. The CONTRACTOR is required to conform to State water quality standards as prescribed in Chapter 62-302.530, F.A.C., and to meet the special requirements of any environmental permits that have been

issued.

- F. Turbidity controls shall be inspected by the CONTRACTOR every work day, after every rainfall event of 0.5 inches or greater in a 24 hour period, and after every extreme weather event that could dislodge or damage the turbidity controls, to assure that the turbidity controls remain properly installed, undamaged, and fully functional at all times.

3.02 EROSION CONTROL:

- A. The CONTRACTOR shall prevent and control erosion and water pollution as per Florida Department of Transportation (FDOT) Specification Sections 104-1, 2, 3, 4, 6 and 7 and FDEP regulations and permit conditions.

3.03 MONITORING:

- A. The CONTRACTOR shall conduct and record the results of turbidity monitoring appropriate to the conditions and at the locations, times, and frequencies specified below. An FDEP approved Turbidity Monitoring Log is attached (Appendix A) for the CONTRACTOR's use.
 - 1. Background Monitoring Location: At least 1,000 feet (or as specified in the applicable environmental permit) upstream of any construction activities that may generate turbidity within a canal or conveyance feature outside the construction area, in the middle of the canal, at mid-depth in the water column, and outside of any visible turbidity plume.
 - 2. Compliance Monitoring Location: At a point no greater than 450 feet downstream (or as specified in the applicable environmental permit) of any construction activities discharge locations that may generate turbidity, in the middle of the canal, in the densest portion of any visible plume, at mid-depth.
 - 3. Sampling Time:
 - a. During Activities or Environmental Conditions that Can Generate Construction-Related Turbidity: Water samples for turbidity measurement shall be collected beginning no sooner than one hour after and no later than two hours after construction activity commences (or as specified in the applicable environmental permit) and every four hours thereafter until the work day ends. Water samples shall be collected at the same time(s) every work day according to this schedule. Any substantial deviation from this schedule must be approved by the DISTRICT, unless otherwise compelled by force majeure, in which case, an explanation must be provided verbally as soon as possible and in writing within 48 hours of the deviation.
 - b. During Activities and Conditions That Cannot Generate Construction-Related Turbidity: Once daily at 10:00 AM or as specified in the applicable environmental permit.
 - 4. Equipment: The turbidity monitoring equipment shall meet the specifications and be calibrated, maintained, repaired, and replaced according to the methods, procedures, and frequencies set forth in Chapter 62-160, F.A.C.
 - 5. Records Management: The individual conducting the turbidity monitoring shall transcribe the readings to the approved Turbidity Log Form (Appendix A) and sign and date the form at the close of each monitoring day. The notebook containing the signed and dated daily turbidity log forms shall be accessible at the construction site during the work day.
- B. The CONTRACTOR shall submit quarterly monitoring data (turbidity Log Forms), to the DISTRICT.

Documents submitted shall contain the following information:

1. Permit number
 2. Project name
 3. Dates of sampling and analysis
 4. A statement describing the methods used in collection, handling, storage and analysis of the samples
 5. A map indicating the sampling locations
 6. A statement by the individual responsible for implementation of the sampling program concerning the authenticity, precision, limits of detection and accuracy of the data.
- C. The CONTRACTOR shall submit monitoring reports that also include the following information for each sample that is taken:
1. Time of day samples taken
 2. Depth of water body
 3. Depth of sample
 4. Antecedent weather conditions
 5. Water level stage
 6. Direction of flow

3.04 EXCEEDANCES OF WATER QUALITY STANDARDS

- A. If at any time, monitoring reveals the turbidity levels, at the compliance sampling station is greater than 29 NTUs above the corresponding background sample in Class I or III receiving waters or greater than 0 NTU above background samples in receiving waters classified as OFW (Outstanding Florida Waters), construction activities shall cease immediately and not resume until corrective measures have been taken and turbidity has returned to acceptable levels. Turbidity violations and corrective measures shall be documented in the monitoring reports.
- B. The CONTRACTOR must notify the DISTRICT Construction Manager and the DISTRICT's Permitting and Compliance Staff immediately who then, per the permit, must notify the permitting agency of the exceedance. If known, the CONTRACTOR may also contact the assigned Permitting and Compliance Staff for the Project directly.

END OF SECTION

APPENDIX A

TURBIDITY MONITORING LOG

A site map depicting sampling locations must accompany the quarterly turbidity monitoring reports

| | |
|-----------------|-------------|
| Project Name: | Permit No.: |
| Collector Name: | Date: |

| Water Observations | | Weather Observations | |
|--------------------|--|----------------------|--|
| Water Level Stages | | Temperature: | |
| Direction of Flow | | Conditions: | |
| Water Depth | | | |

| Activities Taking Place During Sampling | | |
|---|-----|----|
| Activity | Yes | No |
| Excavation or Filling within 50 ft of Water Body? | | |
| <u>Other In-Water Work?</u> (e.g., dewatering; installing piling or forms; injecting concrete; sand blasting; painting) | | |
| <u>Other Activity?</u> (e.g., materials transfer; washdown; interim stabilization) | | |
| | | |

| Background Station Data | A.M. Mid-Depth | Mid-Day Mid-Depth | P.M. Mid-Depth |
|-------------------------|----------------|-------------------|----------------|
| Describe Location: | | | |
| Collection Time | | | |
| Analysis Time | | | |
| Turbidity (NTU) | | | |
| Analysis Date | | | |

| Compliance Station Data | A.M. Mid-Depth | Mid-Day Mid-Depth | P.M. Mid-Depth |
|---|---|---|---|
| Describe Location: | | | |
| Collection Time | | | |
| Analysis Time | | | |
| Turbidity (NTU) | | | |
| Analysis Date | | | |
| Was Compliance Sample more than 29 NTU's above Background Sample? | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| If the 29 NTU limitation was exceeded, please describe cause (e.g., excessive rainfall; interim stabilization failure; BMP capacity exceedance, short-circuiting, or other causes), location(s) (depicted on attached site map), and corrective actions taken describe on reverse side. | | | |

| |
|--|
| Comments (on reverse side of this form): |
|--|

| Statement of Authenticity | |
|--|-------|
| I certify this test was conducted with a calibrated device and that the results are complete and accurate. Signature: | Date: |

SECTION 02920 SODDING

PART 1 - GENERAL

1.01 SCOPE:

- A. This section generally defines CONTRACTOR's responsibilities, unless otherwise indicated, for the following:
 - 1. Preparation of subsoil
 - 2. Placing topsoil
 - 3. Fertilizing
 - 4. Sod installation
 - 5. Maintenance

1.02 REFERENCES:

- A. FDOT - Florida Department of Transportation - Standard Specifications for Road and Bridge – 2004 (Section 575)

1.03 SUBMITTALS:

- A. Submit sod certification for grass species and location of sod source.

1.04 QUALITY ASSURANCE:

- A. Sod Producer: Company specializing in sod production and harvesting with minimum five years experience, and certified by the State of Florida.
- B. Installer: Company approved by the sod producer.
- C. Sod: Minimum age of 18 months, with root development that will support its own weight, without tearing, when suspended vertically by holding the upper two corners.
- D. The DISTRICT reserves the right to test, reject or approve all materials before application.

1.05 REGULATORY REQUIREMENTS:

- A. Comply with regulatory agencies for fertilizer.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to site under provisions of SECTION 01600.
- B. Store and protect products under provisions of SECTION 01600.
- C. Deliver sod on pallets. Protect exposed roots from dehydration.
- D. Do not deliver more sod than can be laid within 48 hours.
- E. Deliver fertilizer in water proof bags showing weight, chemical analysis, and name of manufacturer.
- F. The CONTRACTOR shall furnish the DISTRICT invoices of all materials received in order that the minimum application rate of materials may be determined.

1.07 MAINTENANCE SERVICE:

- A. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

1.08 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Sod:
 - 1. The sod shall be Argentine Bahia, to closely match existing, with well matted roots.
 - 2. The sod shall be commercial size rectangular measuring 12-inches by 24 inches or larger.
 - 3. The sod shall be sufficiently thick to secure a dense stand of live grass, with a minimum thickness of 2-inches.
 - 4. The sod shall be live, fresh and uninjured at the time of planting.
 - 5. The sod shall have a soil matt of sufficient thickness adhering firmly to the roots to withstand all necessary handling and be reasonably free of weeds and other grasses.
 - 6. The sod shall be planted as soon as possible after being harvested, and shall be shaded and kept moist from the time of harvesting until it is planted.
 - 7. The source of the sod may be inspected and approved by the DISTRICT prior to construction
- B. Topsoil:
 - 1. Excavated from site and free of weeds.
- C. Fertilizer:
 - 1. Commercial fertilizer shall be Ammonium Sulfate (21-0-0-24S) containing 21 percent nitrogen and 24 percent sulfur. Fertilizer containing phosphorus is not acceptable. Fertilizer shall be applied in accordance with manufacturer's recommendations.
- D. Water:
 - 1. Clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Verify that prepared subsoil is ready to receive the work of this Section.

3.02 FERTILIZING:

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to installation of sod.

- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.03 LAYING SOD:

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.
- C. Peg sod at locations where sod may slide.
- D. Roll sod using a lightweight turf roller to provide a true and even surface.

3.04 MAINTENANCE:

- A. Water all newly grassed areas once a week to prevent grass and soil from drying out.
- B. Immediately replace sod in areas which show deterioration or bare spots.
- C. CONTRACTOR shall include in pricing, water and equipment to insure adequate survival of the sod for sixty days after substantial completion.

END OF SECTION

SECTION 03100 CONCRETE FORMWORK AND ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONTRACTOR shall provide all labor, materials and equipment for the following:
 - 1. Design and construction of all necessary formwork including the required bracing, supports, scaffolding, shoring, and other falsework to produce cast-in-place concrete in the finished structure within the required tolerances for line, grade dimension and detail.
 - 2. Joints in concrete, complete and in place, in accordance with the Contract Documents. Joints in concrete structures shall be the types defined below and will be permitted only where indicated, unless specifically accepted by the DISTRICT.
 - 3. SECTION 03300 - Cast-in-Place Concrete
 - 4. SECTION 07920 - Sealants and Caulking

1.02 APPLICABLE PUBLICATIONS: The following standard specifications shall apply to the WORK of this SECTION:

- A. American Concrete Institute (ACI)
 - 1. ACI 347 - Recommended Practice for Concrete Formwork
 - 2. ACI 117 - Standard Tolerances for Concrete Construction and Materials
- B. American Society of Testing and Materials (ASTM)
 - 1. A775 - Epoxy Coated Reinforcing Steel Bars
 - 2. C920 - Elastomeric Joint Sealant
 - 3. D412 - Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension
 - 4. D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
 - 5. D638 - Standard Test Method for Tensile Properties of Plastics
 - 6. D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 - 7. D747 - Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
 - 8. D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber
 - 9. D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
 - 10. D2000 - Standard Classification System for Rubber Products in Automotive Applications
 - 11. D2240 - Standard Test Method for Rubber Property - Durometer Hardness
 - 12. D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- C. US Product Standards (PS)
 - 1. PS-1 - Construction and Industrial Plywood for Concrete Forms
 - 2. PS-20 - American Softwood Lumber Standard
- D. NSF International

1. NSF 61 - Drinking Water System Components - Health Effects
- E. United States Army Corps of Engineers (USACE)
 1. CRD-C572 - PVC Waterstops
- F. Federal Specifications
 1. TT-S-0227 E(3) - Sealing Compound, Elastomeric Type, Multicomponent, for Caulking, Sealing, and Glazing Buildings and Other Structures
- G. Occupational Safety and Health Association (OSHA)
 1. CFR Title 29 Part 1926 - Safety and Health Regulations for Construction

1.03 DEFINITIONS:

A. Construction Joints:

1. When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. If indicated on the drawings, joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape indicated. The surface of the first pour may also be required to receive a coating of bond breaker as indicated.

B. Contraction Joints:

1. Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the earlier pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint, which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the later pour. Waterstop and/or sealant groove shall also be provided when indicated.

C. Expansion Joints:

1. To allow the concrete to expand freely, a space is provided between the two pours, and the joint shall be formed as indicated. The space is obtained by placing a filler joint material against the earlier pour, to act as a form for the later pour. Unless otherwise indicated, expansion joints in water bearing members shall be provided with a center-bulb type waterstop as indicated.
2. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.
3. The space so formed shall be filled with a joint sealant material as indicated herein. In order to keep the two walls or slab elements in line the joint shall also be provided with a sleeve-type dowel as indicated.

D. Control Joints:

1. The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions indicated, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material.

1.04 SUBMITTALS:

- A. Falsework Calculations and Drawings: The CONTRACTOR shall submit calculations and drawings prepared and sealed by a Professional Civil Engineer registered in the State of Florida, which indicate the falsework complies with the requirements of OSHA Title 29, Part 1926.703. The submission of design details and calculations for falsework is for information only.

- B. The plans of falsework proposed to be used shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, means of protecting existing construction which supports falsework, and typical soil conditions.
- C. The CONTRACTOR shall submit placement drawings showing the location and type of all joints for each structure.
- D. Prior to production of the waterstop materials required under this SECTION, qualification samples of waterstops shall be submitted which represent in all respects the material proposed. Such samples shall consist of extruded or molded sections of each size or shape to be used. The balance of the material to be used shall not be produced until after the DISTRICT has reviewed the qualification samples.
- E. Prior to use of the waterstop material in the field, a sample of a prefabricated (shop made fitting) mitered cross and a tee constructed of each size or shape of material to be used shall be submitted. These samples shall be prefabricated (shop made fitting) so that the material and workmanship represent in all respects the fittings to be provided. Field samples of prefabricated (shop made fitting) fittings (crosses, tees, etc.) may also be selected at random by the DISTRICT for testing by a laboratory at the DISTRICT's expense. When tested, tensile strength across the joints shall be at least 1120 psi.
- F. The CONTRACTOR shall submit MANUFACTURER's information demonstrating compliance with requirements for the following:
 - 1. Form ties and related accessories, including taper tie plugs, if taper ties are used
 - 2. Form gaskets
 - 3. Form release agent, including NSF certification if not using mineral oil
 - 4. List of form materials and locations for use
 - 5. Bearing Pads
 - 6. Neoprene Sponge
 - 7. Preformed Joint Filler
 - 8. Backing Rod
 - 9. Bond Breaker
 - 10. Waterstops
 - 11. Slip Dowels
 - 12. PVC Tubing

1.05 QUALIFICATIONS:

- A. Every person responsible for waterstop installation is required to have a current individual Certification from the waterstop MANUFACTURER on file with the DISTRICT, which states said individuals are certified and trained to install waterstop per MANUFACTURER's recommendations and specifications.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR is fully responsible for the design and construction of all forms and falsework to be in compliance with all applicable OSHA requirements, and the requirements of all agencies having jurisdiction on the project. The submission of design details and calculations for falsework is for information only.

- B. The CONTRACTOR shall prepare adhesion and cohesion test specimens for construction joint sealant as required herein, at intervals of 5 working days while sealants are being installed.
- C. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:
 - 1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1-inch.
 - 2. Sealant shall be cast and cured according to MANUFACTURER's recommendations except that curing period shall be not less than 24 hours.
 - 3. Following curing period, the gap between blocks shall be widened to 1-1/2-inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.07 CERTIFICATIONS:

- A. Form materials, which may remain or leave residues on or in the concrete, shall be certified as compliant with NSF 61.
- B. Joint materials shall be certified as compliant with NSF 61.
- C. The CONTRACTOR shall submit certified test reports from the sealant MANUFACTURER on the actual batch of material being supplied indicating compliance with requirements herein before the sealant is used on the job.
- D. The CONTRACTOR shall provide copies of the Waterstop Welding Certifications provided by MANUFACTURER or authorized agent of MANUFACTURER for every person who is to be involved with waterstop installation.

1.08 INSPECTIONS:

- A. Falsework shall be inspected for conformance with the accepted submittal. No workers will be allowed to use falsework for access and no concrete placement to related forms will be permitted until the falsework is inspected by the CONTRACTOR for conformance with the submittals and appropriately tagged. No variations or alterations to falsework, as compared to the reference submittal, will be allowed without certification of the variation by the original Professional Engineer.
- B. All waterstop field joints shall be subject to rigid inspection, and no such WORK shall be scheduled or started without having made prior arrangements with the DISTRICT for the required inspections. Not less than 24 hours advance notice shall be given for scheduling such inspections.
- C. Field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects, which would reduce the potential resistance of the material to water pressure at any point. Defective joints shall be replaced with material, which passes inspection; faulty material shall be removed from the site and properly disposed of.
- D. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:
 - 1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less
 - 2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16-inch or 15 percent of material thickness, at any point, whichever is less
 - 3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less

4. Misalignment of joint which results in misalignment of the waterstop in excess of 1/2-inch in 10 feet
5. Porosity in the welded joint as evidenced by visual inspection
6. Bubbles or inadequate bonding which can be detected with a penknife test (If, while prodding the entire joint with the point of a penknife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)
7. Visible signs of separation when the cooled splice is bent by hand at any sharp angle
8. Any evidence of burned material

1.09 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 FORM AND FALSEWORK MATERIALS:

- A. Except as otherwise expressly accepted by the DISTRICT, lumber brought on the Site for use as forms, shoring, or bracing shall be new material. Forms shall be smooth surface forms and shall be of the following materials:
 - Walls - Steel, fiberglass, or plywood panel
 - Columns - Steel, plywood, PVC, fiberglass, or spiral wound fiber forms
 - Roof and floor - Plywood
 - All other work - Steel panels, fiberglass, or plywood
- B. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:
 1. Plywood shall be new, waterproof, synthetic resin bonded, exterior type, manufactured especially for concrete formwork and shall conform to Plyform Class I, B-B EXT, of PS-1, and shall be edge sealed.
 2. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with PS 20.
 3. Form materials shall be metal, wood, plywood, or other material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade indicated. Metal forms shall accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO EXT Grade.
- C. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers or be tooled to 1/2-inch radius. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.
- D. Forms and falsework to support the roof and floor slabs shall be designed in accordance with ACI 347.

2.02 FORM TIES:

- A. Ties shall be standard crimped snap ties with one-inch (1") snapback. Ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties for water-retaining structures shall have integral waterstops that tightly fit the form tie so that they cannot be moved from mid-point of the tie.

- B. Removable taper ties may be used when approved by the DISTRICT. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

2.03 FORM RELEASING AGENT:

- A. Form release agent shall be non-staining and shall leave no residues on or in the concrete unless certified as compliant with NSF 61 and shall not adversely affect the adhesion of paint or other coatings.

2.04 WATERSTOPS:

A. PVC Waterstops:

1. PVC Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of this SECTION. No reclaimed or scrap material shall be used. The CONTRACTOR shall obtain from the waterstop MANUFACTURER and shall furnish to the DISTRICT for review, current test reports and a written certification of the MANUFACTURER that the material to be shipped to the job meets the physical requirements as outlined in the USACE CRD-C572, and those listed herein.
2. Flatstrip and Center-Bulb Waterstops: The thickness of waterstops, including the center bulb, shall not be less than 3/8-inch. Waterstop shall be provided with factory installed hog rings at 12 inches on centers along the waterstop.
3. Multi-Rib Waterstops: Multi-rib waterstops where required shall have prefabricated (shop made fitting) joint fittings at all intersections of the ribbed-type waterstops.
4. Retrofit Waterstops: Retrofit waterstops and batten bars shall be manufactured as a complete system including waterstop, SS batten bar, SS anchor bolts, and epoxy gel.
5. Waterstop Testing Requirements: When tested in accordance with the test standards, the waterstop material shall meet or exceed the following requirements:

| Property | Value | ASTM Standard |
|--|---------------|----------------|
| <u>Physical Property, Sheet Material</u> | | |
| Tensile Strength-min (psi) | 2000 | D 638, Type IV |
| Ultimate Elongation-min (percent) | 350 | D 638, Type IV |
| Low Temp Brittleness-max (degrees F) | -35 | D 746 |
| Stiffness in Flexure-min (psi) | 600 | D 747 |
| <u>Accelerated Extraction (CRD-C572)</u> | | |
| Tensile Strength-min (psi) | 1500 | D 638, Type IV |
| Ultimate Elongation-min (percent) | 300 | D 638, Type IV |
| <u>Effect of Alkalies (CRD-C572)</u> | | |
| Change in Weight (percent) | + 0.25/- 0.10 | ----- |
| Change in Durometer, Shore A | +/- 5 | D 2240 |
| <u>Finish Waterstop</u> | | |
| Tensile Strength-min (psi) | 1400 | D 638, Type IV |
| Ultimate Elongation-min (percent) | 280 | D 638, Type IV |

B. Pre-formed Hydrophilic Waterstops:

1. Hydrophilic (bentonite-free) waterstops shall be the type that expands in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.

2. Waterstop shall be manufactured from chloroprene rubber and modified chloroprene rubber with hydrophilic properties. Waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete. The minimum expansion ratio of modified chloroprene shall be not less than 2 to 1 volumetric change in distilled water at 70 degrees F (21 degrees C).
3. Hydrophilic Waterstop shall meet the following minimum requirements:

| Property | Value | ASTM Standard |
|--|----------|---------------|
| <u>Physical Property, Chloroprene</u> | | |
| Tensile Strength-min (psi) | 1275 | D 412 |
| Ultimate Elongation-min (percent) | 350 | D 412 |
| Hardness, Shore A | 55 +/- 5 | D 2240 |
| <u>Physical Property, Modified Chloroprene</u> | | |
| Tensile Strength-min (psi) | 300 | D 412 |
| Ultimate Elongation-min (percent) | 600 | D 412 |
| Hardness, Shore A | 55 +/- 5 | D 2240 |

4. Bonding agent for hydrophilic waterstop shall be the MANUFACTURER's recommended adhesive for wet, rough concrete.

C. Other Types of Waterstops:

1. When types of waterstops not listed above are indicated, they shall be subjected to the same requirements as those listed herein.

2.05 JOINT SEALANT FOR WATER BEARING JOINTS:

- A. Joint sealant shall be polyurethane polymer designed for bonding to concrete, which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.
- B. Joint sealant material shall meet the following requirements (73 degrees F and 5percent R.H.):

| Requirement | Value | ASTM Standard |
|--|-------------------|---------------|
| Work Life (minutes) | 45 - 180 | ----- |
| Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity) - max (hours) | 24 | ----- |
| Ultimate Hardness | 20 - 45 Shore "A" | D 2240 |
| Tensile Strength - min (psi) | 175 | D 412 |
| Ultimate Elongation - min (percent) | 400 | D 412 |
| Tear Resistance - min (pounds per inch of thickness) | 75 | D 624 (Die C) |
| Color | Light Gray | ----- |

- C. Polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:
 1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ASTM C 920, or TT-S-0227 E(3) for 2-part material, as applicable.
 2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ASTM C 920 Class 25, Grade NS, or TT-S-0227 E(3), Type II, Class A.
 3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ASTM C 920 Class 25, Grade P, or TT-S-0227 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.

4. Primer materials, if recommended by the sealant MANUFACTURER, shall conform to the printed recommendations of the MANUFACTURER.
- D. Sealants for non-waterstop joints in concrete shall conform to SECTION 07920.

2.06 JOINT MATERIALS:

- A. Bearing Pad: Bearing pad shall be neoprene conforming to ASTM D 2000, BC 420, 40 durometer hardness unless otherwise indicated.
- B. Neoprene Sponge: Sponge shall be neoprene, closed-cell, expanded, conforming to ASTM D 1056, Type 2C5-E1.
- C. Joint Filler
 1. Joint filler for expansion joints in waterholding structures shall be neoprene conforming to ASTM D1056, Type 2C5-E1.
 2. Joint filler material in other locations shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752, for Type I, except as otherwise indicated.

2.07 BACKING ROD:

- A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at eight (8) psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.08 BOND BREAKER:

- A. Bond breaker shall contain a fugitive dye so that areas of application will be readily distinguishable.
- B. Bonding agent for hydrophilic waterstop shall be the MANUFACTURER's recommended adhesive for wet, rough concrete.

2.09 SLIP DOWELS:

- A. Slip dowels in joints shall be smooth epoxy-coated bars, conforming to ASTM A 775.

2.10 PVC TUBING:

- A. PVC tubing in joints shall be Schedule SDR 13.5, conforming to ASTM D 2241.

2.11 CHAMFER STRIP:

- A. Provide three quarter inch triangular fillets, milled clear straight grained wood, surfaced each side, or extruded vinyl type, with or without nail flange to form all exposed concrete edges such as columns, pilasters, beams, curbs, equipment pads, tops of walls, and as indicated. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4" chamfers. Re-entrant corners in concrete members shall not have fillets, unless otherwise indicated.

PART 3 - EXECUTION

3.01 FORMS:

- A. Forms shall conform to the shape, lines, and dimensions as shown on the Drawings and shall be substantial and sufficiently tight to prevent leakage. Forms shall be properly braced or tied so as to maintain position and shape. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by CONTRACTOR's personnel and by the DISTRICT and shall be in sufficient number and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.
- B. The CONTRACTOR shall be fully responsible for the adequacy of the formwork in its entirety and any forms that are unsafe or inadequate in any respect shall promptly be removed from the WORK and replaced. The CONTRACTOR shall provide worker protection from protruding reinforcement bars in accordance with applicable safety codes.
- C. The CONTRACTOR may reuse forms only if in good condition and only if acceptable to the DISTRICT. Reused forms shall be thoroughly cleaned and may require light sanding between uses to obtain a uniform surface texture on all exposed concrete surfaces. Forms shall not be reused if they have developed defects that would affect the surface texture of exposed concrete. Exposed concrete surfaces are defined as surfaces, which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the DISTRICT.
- D. Forms shall be sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.
- E. Immediately before the placing of reinforcing, faces of all forms in contact with concrete shall receive a thorough coating of form release agent. Any excess agent shall be satisfactorily removed before placing concrete. If using mineral oil, the CONTRACTOR shall oil the forms at least two weeks in advance of their use. Care shall be exercised to keep oil/release agent off the surfaces of steel reinforcement and other items to be embedded in concrete.
- F. The CONTRACTOR shall supply sufficient number of forms of each kind to permit the required rate of progress to be maintained.
- G. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state, and Federal regulations.

3.02 WATERSTOPS:

- A. Waterstops shall be embedded in the concrete across joints as indicated. Waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of MANUFACTURER of the waterstops. The CONTRACTOR shall take suitable precautions and means to support and protect the waterstops during the progress of the WORK and shall repair or replace at its own expense any waterstops damaged during the progress of the WORK. Waterstops shall be stored so as to permit free circulation of air around the waterstop material.
- B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.03 SPLICES IN PVC WATERSTOPS:

- A. Splices in PVC waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the MANUFACTURER's printed recommendations. It is essential that:
 - 1. The material not be damaged by heat sealing.

2. The splices have a tensile strength of not less than 80 percent of the unspliced material tensile strength.
 3. The continuity of the waterstop ribs and of its tubular center axis be maintained. No edge welding is allowed.
- B. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.
- C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated (shop made fitting) prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated (shop made fitting) waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.
- D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.04 FORM DESIGN:

- A. Forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete.
- B. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement, and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form.
- C. The CONTRACTOR shall provide adequate clean-out holes at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the DISTRICT. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, form windows shall be provided in the size and spacing needed to allow placement of concrete to the requirements of SECTION 03300. The size, number, and location of such form windows shall be as acceptable to the DISTRICT.

3.05 FORM CONSTRUCTION:

- A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is indicated. Not less than 1-inch of concrete shall be added to the indicated thickness of a concrete member, where concrete is permitted to be placed against trimmed ground, in lieu of forms. Permission to do this on other concrete members will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.
- B. Construction Joints: Concrete construction joints will not be permitted at locations other than those indicated, except as may be acceptable to the DISTRICT. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.
- C. Form Ties

1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties, which cause spalling of the concrete upon form stripping or tie removal, will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.
2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls, which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout, which shall match the color and texture of the surrounding wall surface.

3.06 JOINT CONSTRUCTION:

A. Setting Waterstops:

1. In order to eliminate faulty installation that may result in joint leakage, the CONTRACTOR shall be particularly careful to get the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the WORK and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.
2. In placing PVC waterstops in the forms, the CONTRACTOR shall provide means to prevent the waterstop from being folded over by the concrete as it is placed. Waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through hog rings at the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, the CONTRACTOR shall work concrete under the waterstops by hand so as to avoid the formation of air and rock pockets.
3. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.
4. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to a future concrete placement.

B. Joint Location:

1. Construction joints and other types of joints shall be provided where indicated. When not indicated, construction joints shall be provided at 25-foot maximum spacing for all concrete construction. Where joints are indicated spaced greater than 40 feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing. The location of all joints, of any type, shall be submitted for acceptance by the DISTRICT.

C. Joint Preparation:

1. The CONTRACTOR shall take special care in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise indicated, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of SECTION 03300. Except on horizontal wall construction joints, wall to slab joints, or where otherwise indicated, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as indicated herein.

D. Retrofit Joint Preparation:

1. Existing surfaces to receive a retrofit waterstop shall be clean and free from any loose or foreign material. Surface shall be given a light sandblast or hydroblast finish to 1/8-inch amplitude prior to application of epoxy and waterstop.

E. Construction Joint Sealant:

1. Construction joints in water-bearing floor slabs, and elsewhere as indicated, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sandblasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer shall be furnished by the sealant MANUFACTURER. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.
2. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the MANUFACTURER, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. Sealant shall achieve final cure at least 7 days before the structure is filled with water.
3. Sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations.
4. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, the CONTRACTOR shall arrange to have the crew doing the WORK carefully instructed on the proper method of mixing and application by a representative of the sealant MANUFACTURER.
5. Any joint sealant which fails to fully and properly cure after the MANUFACTURER's recommended curing time for the conditions of the WORK hereunder shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the indicated joint sealant. Costs of such removal, joint treatment, re-sealing, and appurtenant WORK shall be the CONTRACTOR's responsibility.

F. Hydrophilic Waterstop

1. Where a hydrophilic waterstop is called for in the Contract Documents, it shall be installed with the MANUFACTURER's instructions and recommendations except as modified herein.
2. When requested by the DISTRICT, the CONTRACTOR shall arrange for the MANUFACTURER to furnish technical assistance in the field.
3. Hydrophilic waterstop shall only be used where complete confinement by concrete is provided. Hydrophilic waterstop shall not be used in expansion or contraction joints or in the first 6 inches of any non-intersecting joint.

4. The hydrophilic waterstop shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 5 inches.
 5. Where the thickness of the concrete member to be placed on the hydrophilic waterstop is less than 12 inches, the waterstop shall be placed in grooves formed or ground into the concrete. The groove shall be at least 3/4 inch deep and 1-1/4 inches wide. When placed in the groove, the minimum distance from the edge of the waterstop to the face of the member shall be 2.5 inches.
 6. Where a hydrophilic waterstop is used in combination with PVC waterstop, the hydrophilic waterstop shall overlap the PVC waterstop for a minimum of 6 inches and shall be adhered to PVC waterstop with single component water-swelling sealant as recommended by MANUFACTURER.
 7. The hydrophilic waterstop shall not be installed where the air temperature falls outside the MANUFACTURER's recommended range.
 8. The concrete surface under the hydrophilic waterstop shall be smooth and uniform. The concrete shall be ground smooth if needed. Alternately, the hydrophilic waterstop shall be bonded to the surface using an epoxy grout which completely fills all voids and irregularities beneath the waterstop material. Prior to installation, the concrete surface shall be wire brushed to remove any laitance or other materials that may interfere with the bonding of epoxy.
 9. The hydrophilic waterstop shall be secured in place with concrete nails and washers at 12-inch maximum spacing. This shall be in addition to the adhesive recommended by the MANUFACTURER
- G. Retrofit Waterstop:
1. Retrofit waterstops shall be set in a bed of epoxy over a sandblasted surface with stainless steel batten bars and 1/4-inch diameter stainless steel anchors at 6 inches on center, staggered, and in accordance with the MANUFACTURER's written recommendations.

3.07 REMOVAL OF FORMS:

- A. Careful procedures for the removal of forms shall be strictly followed, and this WORK shall be done with care so as to avoid injury to the concrete or workers. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength (0.75f_c) in SECTION 03300. No forms shall be disturbed or removed under an individual panel or unit before the concrete in all the adjacent panels or units have attained 0.75f_c strength and have been in place for a minimum of 7 days. The time required to establish said strength shall be determined by the DISTRICT, who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for vertical walls of waterholding structures shall remain in place at least 36 hours after the concrete has been placed.
- B. Forms for parts of the WORK not specifically mentioned herein shall remain in place for periods of time as recommended in ACI 347.

3.08 FALSEWORK:

- A. The CONTRACTOR shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements herein.

- B. The CONTRACTOR shall design and construct falsework to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.
- C. The CONTRACTOR shall place falsework upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall be as recommended by the CONTRACTOR's geotechnical engineer and shall not exceed 20 tons. When falsework is supported on any portion of the structure which is already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

3.09 TOLERANCES:

- A. The variation from plumb, level and required lines shall not exceed 1/4-inch in any ten feet (10') of length, non cumulative, and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances of ACI 117 - Standard Tolerances for Concrete Construction and Materials.

END OF SECTION

SECTION 03200 CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONTRACTOR shall furnish all labor, materials and equipment to provide and properly place all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in the reinforced concrete and masonry construction and all appurtenant work, including all the wires, clips, supports, chairs, spacers, and other accessories as shown on the drawings and as specified herein.
 - 1. SECTION 03100 - Concrete Formwork and Accessories
 - 2. SECTION 03300 - Cast-In-Place Concrete
 - 3. SECTION 03400 - Structural Precast Concrete
 - 4. SECTION 03600 - Grout

1.02 APPLICABLE PUBLICATIONS: The most recent revision of the following standard specifications shall apply to the WORK of this SECTION:

- A. American Concrete Institute (ACI):
 - 1. ACI 318 - Building Code Requirements for Reinforced Concrete
 - 2. ACI SP-66 - Detailing Manual
- B. American Society of Testing and Materials (ASTM):
 - 1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 - 2. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
 - 3. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 4. ASTM A775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars
- C. Concrete Reinforcing Steel Institute (CRSI):
 - 1. Recommended Practice for Placing Reinforcing Bars
- D. Florida Building Code, Latest Edition

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS: The CONTRACTOR shall submit the following:

- A. Mill Certifications of Grade 60 reinforcing steel or stainless steel, as required
- B. Complete bar schedule, bar details and erection drawings in conformance with ACI SP-66
- C. Mill certificates shall be delivered with each shipment of reinforcing bars.

1.05 QUALIFICATIONS: (Not Used)

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall perform Pull tests to 50 percent of five percent of drilled dowels, randomly selected by the DISTRICT. If any tested dowels slip or yield, an additional five percent of drilled dowels shall be tested until an entire five percent sample is tested without slipping or yielding.

1.07 CERTIFICATIONS:

- A. International Code Council Evaluation Service (ICC-ES) Certifications for mechanical couplers, if allowed
- B. Mill Certifications of Grade 60 reinforcing steel

1.08 INSPECTION COORDINATION:

- A. The CONTRACTOR shall provide sufficient notice and opportunity to the DISTRICT to review the placement of the reinforcing steel before the concrete is placed. The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 REINFORCING BARS:

- A. Metal reinforcement shall be deformed type bars conforming to ASTM A615, Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Grade 60, unless otherwise specified. Reinforcing steel shall be fabricated for the shapes and dimensions indicated on the Drawings and in compliance with ACI 318. All bars shall be bent cold.
- B. Replace all reinforcement with bends and kinks not shown on fabrication Shop Drawings. Remove from job site all such reinforcing and replace with new fabricated steel. Field bending of reinforcement at the work site is prohibited.
- C. Welded wire fabric reinforcement shall conform to the requirements of ASTM A185, and the details indicated. Do not use fabric that has been rolled. Install flat sheets only.
- D. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A82.
- E. Mechanical couplers shall be provided where indicated and where approved by the DISTRICT. The couplers shall develop a tensile strength that exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be provided. This shall apply to all mechanical splices, including those splices intended for future connections. Reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.
- F. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements in SECTION 03600.

2.02 ACCESSORIES: All chairs and bolsters shall conform to ACI SP-66 and the CRSI Manual of Standard Practices and shall have galvanized or plastic legs.

PART 3 - EXECUTION

3.01 PLACEMENT AND ANCHORAGE:

- A. Bar supports shall be spaced in accordance with CRSI.
 - 1. Reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers that are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. Concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties that are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall provide concrete, metal, plastic, or other acceptable bar chairs and spacers.
 - 2. Limitations on the use of bar support materials shall be as follows.
 - a. Concrete Dobies: permitted at all locations except where architectural finish is required.
 - b. Wire Bar Supports: permitted only at slabs over dry areas, interior non-hydraulic wall surfaces, and exterior wall surfaces.
 - c. Plastic Bar Supports: permitted at all locations except on grade.
- B. Reinforcement shall be accurately placed in accordance with the Drawings and shall be adequately secured in position with not less than 16-gauge annealed wire. The placement tolerances shall be in accordance with ACI 318, paragraph 7.5, Placing Reinforcement and the CRSI Manual of Standard Practices.
- C. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.
- D. Bars additional to those indicated which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at its own expense.
- E. Additional reinforcement around openings:
 - 1. Place an equivalent area of steel around pipe or opening and extend on each side and top and bottom sufficiently to develop bond in each bar.
 - 2. Refer to details on Drawings for bar extension length on each side of opening.
 - 3. Where welded wire fabrics are used, provide extra reinforcing using fabric or deformed bars.
- F. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.
- G. Bars may be moved as necessary to avoid interference with other reinforcement steel continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane indicated.
- H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than three (3) feet on centers in any direction. Welded wire fabric shall not be placed on the ground and hooked into place in the freshly placed concrete.
- I. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30 inches on center. The construction practice of placing welded wire fabric on the ground and hooking it into place in the freshly placed concrete shall not be used.

3.02 CONCRETE COVER:

- A. The concrete cover over reinforcement shall conform to ACI 318, paragraph 7.7, Concrete Protection for Reinforcement, unless otherwise indicated. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.

3.03 SPLICING:

- A. All lap splices of bar reinforcement shall be as indicated and conform to Chapter 12 of ACI 318 or as otherwise approved by the DISTRICT. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.
- B. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each two running feet. Wires shall be staggered and tied in such a manner that they cannot slip.
- C. Splices in column spiral reinforcement, when necessary, shall be made by a lap of 1-1/2 turns.
- D. Reinforcing shall not be straightened or rebent in a manner which will injure the material. Bars shall be bent or straight as indicated. Do not use bends different from the bends indicated. Bars shall be bent cold, unless otherwise permitted by the DISTRICT. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the DISTRICT.
- E. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as indicated. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2 inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.

3.04 CLEANING AND PROTECTION:

- A. Unless indicated otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing indicated for the adjacent section.
- B. Reinforcement shall be free of all materials that will reduce bond.
- C. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.
- D. The surfaces of reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be re-inspected and, if necessary, re-cleaned or sandblasted.
- E. Properly cap all vertical reinforcement steel if area is subject to having workers above the reinforcement area.

3.05 INSTALLATION OF DRILLED REINFORCING STEEL DOWELS:

- A. For drilling and grouting information see SECTION 03600.

END OF SECTION

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE:

- A. The work of this Section consists of furnishing all labor, equipment, supplies, and materials necessary for the proper placement, curing, finishing, protection, and repair of the cast-in-place concrete required by the Contract Documents.
 - 1. SECTION 02200 Earthwork
 - 2. SECTION 03100 Concrete Formwork and Accessories
 - 3. SECTION 03200 Concrete Reinforcement
 - 4. SECTION 03600 Grout

1.02 APPLICABLE PUBLICATIONS: The following standard specifications shall apply to the Work of this Section:

- A. American Concrete Institute (ACI)
 - 1. ACI 117 - Standard Tolerance for Concrete Construction and Materials
 - 2. ACI 301 - Structural Concrete for Buildings
 - 3. ACI 304.2R - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
 - 4. ACI 305 - Committee Report on Hot-Weather Concreting
 - 5. ACI 306 - Committee Report on Cold-Weather Concreting
 - 6. ACI 308 - Standard Specification for Curing Concrete
 - 7. ACI 309 - Consolidation of Concrete
 - 8. ACI 318 - Building Code Requirements for Reinforced Concrete
 - 9. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures
- B. American Society for Testing and Materials (ASTM):
 - 1. C31 - Making and Curing Concrete compression and Flexure Test Specimens in the Field
 - 2. C33 - Concrete Aggregates
 - 3. C39 - Compressive Strength of Cylindrical Concrete Specimens
 - 4. C94 - Ready-Mixed Concrete
 - 5. C127 - Test Method for Specific Gravity and Absorption of Coarse Aggregate
 - 6. C128 - Test Method for Specific Gravity and Absorption of Fine Aggregate
 - 7. C136 - Method for Sieve Analysis of Fine and Coarse Aggregates
 - 8. C143 - Test Method for Slump of Hydraulic Cement Concrete
 - 9. C150 – Standard Specification for Portland Cement
 - 10. C156 - Test Method for Water Retention by Concrete Curing Materials
 - 11. C157 - Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete

12. C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 13. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 14. C260 - Specification for Air Entraining Admixtures for Concrete
 15. C309 - Liquid Membrane-Forming Compounds for Curing Concrete
 16. C494 - Chemical Admixtures for Concrete
 17. C566 - Test Method for Total Moisture Content of Aggregate by Drying
 18. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
 19. C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 20. C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation
 21. C1157 - Performance Specification for Hydraulic Cements
 22. C1240 - Standard Specification for Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
 23. D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 24. D2419 - Test Methods for Sand Equivalent Value of Soils and Fine Aggregate
 25. E96 - Water Vapor Transmission of Materials
 26. E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
- C. Federal Specifications
1. UU-B-790A - Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant)
- D. Florida Building Code and Local Building Codes as appropriate

1.03 DEFINITIONS:

- A. Structural Concrete: Concrete to be used in all cases except where indicated otherwise in the Contract Documents.
- B. Structural Silica Fume Concrete: Silica Fume Concrete shall contain a Silica Fume Admixture per the manufacturer's recommendations. Silica Fume Concrete shall be used in the following locations; concrete weir structure.
- C. Structural Chloride Resistant Concrete: Chloride Resistant Concrete shall contain a Corrosion Inhibitor per the manufacturer's recommendations. Chloride Resistant Concrete shall be used in the following locations; concrete weir structure.
- D. Pea Gravel Concrete: Concrete in thin sections and areas with congested reinforcing, at the option of the CONTRACTOR and with written approval of the DISTRICT for the specific location.
- E. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground pipe encasement, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise indicated.

- F. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles that are indicated on the Drawings as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.
- G. Hydraulic Structure: An environmental engineering concrete structure for the containment, treatment, or transmission of water, wastewater, other fluids, or gases.

1.04 SUBMITTALS:

A. Mix Designs:

- 1. Prior to beginning the WORK and within 14 days of the Notice to Proceed, the CONTRACTOR shall submit preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete. Mix designs shall be checked by an independent testing laboratory acceptable to the DISTRICT. All costs related to such checking shall be CONTRACTOR'S responsibility. Since laboratory trial batches require 35 calendar days to complete, the CONTRACTOR shall test a minimum of two mix designs for each class of concrete.
- 2. Test data relating to the cement, aggregate, and admixtures shall be less than six months old. Furnish the submittals in accordance with ACI 301 for the following:
 - a. Mill tests for cement
 - b. Admixture certification. Chloride ion content shall be included.
 - c. Aggregate gradation test results and certification
 - d. Delivery Tickets:
- 3. Where ready-mix concrete is used, the CONTRACTOR shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the Site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the Site, when unloading began, and when unloading was finished.

B. Other

- 1. The CONTRACTOR shall submit materials and methods for curing.
- 2. The CONTRACTOR shall submit product specifications, data, and installation instructions for all miscellaneous products called for in this specification.

1.05 QUALIFICATIONS: Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

1.06 RESPONSIBILITIES: (not used)

1.07 CERTIFICATIONS AND TESTING:

A. General

- 1. Concrete and other materials for testing shall be furnished by the CONTRACTOR, and the CONTRACTOR shall assist the DISTRICT in obtaining samples, and disposal and cleanup of excess material.
- 2. The testing laboratory will meet or exceed the requirements of ASTM C1077.

3. The cost of trial batch, laboratory, and shrinkage tests on cement, aggregates, and concrete, will be the CONTRACTOR'S responsibility.

B. Trial Batch and Laboratory Tests

1. Tests for determining slump shall be in accordance with the requirements of ASTM C143.
2. Testing for aggregate shall include sand equivalence, reactivity, organic impurities, abrasion resistance, and soundness, according to ASTM C33.
3. A testing laboratory approved by the DISTRICT shall prepare a trial batch of each class of concrete, based on the preliminary concrete mixes submitted by the CONTRACTOR. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments will be considered refinements to the mix design and will not be the basis for extra compensation to the CONTRACTOR. Concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the CONTRACTOR'S preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement, and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 6 compression test specimens from each batch.
4. The determination of compressive strength shall be made in accordance with ACI 318, Section 5.3.
5. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C136. Values shall be given for percent passing each sieve.

C. Shrinkage Tests:

1. Drying shrinkage tests shall be performed for the trial batches, the first placement of each class of structural concrete, and during construction to insure continued compliance with these Specifications.
2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gauge length of 10-inches; fabricated, cured, dried, and measured in accordance with ASTM C157, modified as follows: specimens shall be removed from molds at an age of 23 plus or minus 1 hours after trial batching, shall be placed immediately in water at 70 degrees F plus or minus 3 degrees F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F plus or minus 3 degrees F. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F plus or minus 3 degrees F and 50 percent plus or minus 4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project.

4. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21 day drying age or at 28 day drying age shall be 0.036 percent or 0.042 percent, respectively. Standard deviation will not be considered. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to structural concrete.
5. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.
6. If the required shrinkage limitation is not met during construction, the CONTRACTOR shall take any or all of the following actions to reestablish compliance. These actions may include changing the source of aggregates, cement and/or admixtures; reducing water/cement ratio; washing of coarse and/or fine aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

D. Field Tests

1. The responsibility to retain the services of an independent testing laboratory shall be as defined in SECTION 01410.
2. The CONTRACTOR shall pay the cost of any additional tests and investigation on WORK that does not meet the specifications.
3. Tests on pumped concrete shall be taken at the point of final placement.
4. Compressive Test:

Compressive test specimens shall be taken during construction from the first placement of each class of concrete placed each day and for each 150 cubic yards or fraction thereof each day.

- a. Each set of test specimens shall consist of 5 cylinders. Specimens shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.
 - b. Compression tests shall be performed in accordance with ASTM C39. Two (2) cylinders shall be broken at 7 days and two (2) at 28 days, and the remaining cylinder shall be held to verify test results, if needed.
 - c. The acceptance of the test results shall be the average of the strengths of the two specimens tested at 28 days as per ACI 318. Evaluation and acceptance of the concrete shall be per ACI 318, Chapter 5.
5. Slump Tests: One (1) slump test shall be taken per truckload in accordance with ASTM C143.
 6. Air Content: Air content shall be determined for each compressive test taken in accordance with ASTM C231 or by ASTM C173.
 7. Aggregate testing shall be made every 12 months during construction to insure continued compliance with these Specifications.
 8. Concrete that fails to meet the ACI requirements and these Specifications is subject to removal and replacement.
 9. Temperature: Concrete temperature shall be recorded in accordance with ASTM C1064.

1.08 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - MATERIALS

2.01 GENERAL:

- A. All materials shall be classified as acceptable for potable water use according to NSF Standard 61.
- B. Cement for concrete that will contact potable water shall not be obtained from kilns that burn metal rich hazardous waste fuel.
- C. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Cement reclaimed from cleaning bags or leaking containers shall not be used. Cement shall be used in the sequence of receipt of shipments.
- D. Materials shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.
- E. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

2.02 CEMENT:

- A. Cement shall be standard Portland Cement Type III conforming to ASTM C150 and C1157 . A minimum of 85 percent of cement by weight shall pass a 325 screen.
- B. A single brand of cement shall be used throughout the WORK, and prior to its use, the brand shall be accepted by the DISTRICT.
- C. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the DISTRICT, if requested, regarding compliance with these Specifications.

2.03 AGGREGATES:

- A. Aggregates shall be obtained from pits acceptable to the DISTRICT, shall be non-reactive, and shall conform to the requirements of ASTM C33.
- B. When tested in accordance with ASTM C33, the loss resulting after 5 cycles of the soundness test, shall not exceed 10 percent for fine aggregate and 12 percent for coarse aggregate, when using sodium sulfate.
- C. When tested in accordance with ASTM C33, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.
- D. Course Aggregates:
 - 1. Coarse aggregates shall be crushed stone, gravel or other approved inert material having clean, hard, durable, uncoated particles conforming to ASTM C33.
 - 2. The coarse aggregates shall be prepared and handled in 2 or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete, the 2 size groups shall be combined.
 - 3. When tested in accordance with ASTM C33, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.
- E. Fine Aggregates:
 - 1. Fine aggregates shall be clean sand conforming to ASTM C33.
 - 2. When tested in accordance with ASTM D2419, the sand equivalency shall not be less than 75 percent for an average of 3 samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C33 when tested in accordance with ASTM C136 for

the fineness modulus of the sand used, including the optional grading in Section 6.2. The fineness modulus of sand used shall not be over 3.1.

3. When tested in accordance with ASTM C33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

2.04 WATER:

- A. The water used in the concrete mix and for curing shall be clean, potable, and in accordance with ACI 318. Water shall be free from objectionable quantities of silty organic matter, alkali, salts, and other impurities.
- B. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.

2.05 ADMIXTURES:

- A. General: All admixtures shall be compatible and be furnished by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the CONTRACTOR shall discontinue use of the admixture. Admixtures shall not contain thiocyanates or more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.
- B. Air Entraining Admixtures:
 1. Air entraining admixture shall conform to ASTM C260. Air content shall be tested at the point of placement.
 2. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.
 3. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent. Concrete floors to receive a shake-on floor hardener shall have an air content not to exceed 3 percent or as recommended by the hardener manufacturer.
- C. Set Controlling and Water Reducing Admixtures:
 1. Admixtures may be added at the CONTRACTOR'S option, subject to the DISTRICT'S approval, to control the set, effect water reduction, and increase workability. The cost of adding an admixture shall be the CONTRACTOR'S responsibility. Concrete containing an admixture shall be first placed at a location determined by the DISTRICT. Admixtures shall conform to the requirements of ASTM C494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.
 2. Concrete shall not contain more than one water-reducing admixture.
 3. Set retarding admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently greater than 80 degrees F, a set retarding admixture shall be used. Set retarding admixture shall conform to ASTM C494 Type B or D.
 4. Set accelerating admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently less than 40 degrees F, a non-corrosive set accelerating admixture shall be used. Set accelerating admixture shall conform to ASTM C494 Type C or E.
 5. Normal range water reducer shall conform to ASTM C494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.

6. High range water reducer shall conform to ASTM C494, Type F or G. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating the water/cement ratio.
 - a. If the high range water reducer is added to the concrete at the Site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches plus or minus 1/2-inch prior to adding the high range water reducing admixture at the Site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the primary system.
 - b. Concrete shall be mixed at mixing speed for a minimum of 70 mixer revolutions or 5 minutes after the addition of the high range water reducer, unless recommended otherwise by the manufacturer.
- D. Silica Fume Admixture:
 1. Silica fume admixture shall conform to ASTM C1240. Blended cements with interground silica fume will not be allowed. Silica fume admixture shall not effect the setting times of the concrete.
 2. Water content of liquid slurry silica fume admixtures shall be considered as part of the mixing water when calculating the water/cement ratio.
 3. Silica fume shall be added at the batch plant as recommended by the manufacturer. For all types of mixing equipment, mix times shall be increased by 40 percent over the minimum mix time required to achieve mix uniformity as defined by ASTM C94. For truck-mixed and central mixed concrete, maximum allowable batch size shall be 80 percent of the maximum as called out by ASTM C94.
- E. Corrosion Inhibitor: Corrosion inhibitor admixture shall chemically inhibit corrosive action of chlorides on steel. Admixture shall not affect set times of concrete. Mixing water shall be adjusted for the admixture in accordance with the manufacturer's recommendations.
- F. Anti-washout admixture may be used for concrete placed underwater. The admixture shall be added at the manufacturer's recommended dosage rate. The admixture shall be an aqueous solution and the water in such solution shall be counted as mixing water for the purpose of determining the water cement ratio of the concrete. Trial batches shall be made to verify compatibility of the materials and mix design performance.

2.06 CURING MATERIALS:

- A. Curing compound shall conform to ASTM C309, Type I. Curing compound shall be white pigmented, resin based and compliant with local VOC requirements. When curing compound must be removed for finishes or grouting, it shall be of a dissipating type. Sodium silicate compounds shall not be allowed.
- B. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.
- C. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, have a minimum thickness of 2 mils, and be permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

- D. Polyethylene-coated burlap for use as concrete curing blanket shall be minimum 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.
- E. Curing mats for use in Curing Method 6 below, shall be heavy shag rugs or carpets or cotton mats quilted at 4-inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

2.07 MISCELLANEOUS MATERIALS:

- A. Damp proofing agent shall be an asphalt emulsion conforming to ASTM D1227, Type III, Class 1.
- B. Evaporation retardant shall create a monomolecular film on the concrete. The retardant shall have no effect on cement hydration and shall meet local VOC requirements. Evaporation retardant shall not affect adhesion of curing compounds or other treatments and shall not affect the color of the concrete.
- C. Floor hardener shall be provided at the following locations:
 - 1. []
 - 2. Surface hardener shall be system of integral hardening admixture, shake-on hardener, and surface applied liquid hardener acceptable for both indoor and outdoor applications.
 - 3. Integral hardening admixture shall be a non-chloride admixture that will produce high strength, durable, hard, non-dusting abrasive resistant concrete. Admixture shall react with the portland cement to produce more complete hydration.
 - 4. Shake-on hardener shall be a ready to use, heavy-duty emery shake-on floor hardener. Aggregate shall consist of no less than 35% aluminum oxide. Hardener shall produce a hard, non-slip floor that will not rust.
 - 5. Surface applied liquid hardener shall be a water borne chemical hardener and dustproof. Hardener shall meet local VOC requirements and shall be a solution of silicates and fluosilicates.
- D. Reinforcement shall be per SECTION 03200 Concrete Reinforcement.
- E. Water Stops shall be per SECTION 03100 Concrete Formwork.
- F. Damp proofing agent shall be a waterborne emulsified-asphalt. Damp proofing shall be suitable for "green" or slightly damp surfaces and shall withstand normal expansion and contraction of the concrete. Damp proofing agent shall breath to allow vapors to escape. Damp proofing agent shall meet local VOC requirements.
- G. Bonding agents shall be 100% solids, epoxy adhesives conforming to the following:
 - 1. For bonding freshly-mixed, plastic concrete to hardened concrete, bonding agent shall be a medium viscosity adhesive conforming to ASTM C881 Type II, Grade 2, Class C,
 - 2. For bonding hardened concrete or masonry to steel, bonding agent shall be a non-sagging gel adhesive conforming to ASTM C881 Type I or IV, Grade 3, Class C.
- H. Vapor Barrier:
 - 1. Vapor Barrier shall consist of a composite of heavy kraft paper, asphalt, fiberglass reinforcement, and polyethylene film. The composite shall be laminated under heat and pressure.
 - 2. Vapor Barrier shall comply with federal specification UU-B-790A, Type I, Grade A, Style 4. Vapor Barrier shall have a water vapor permeance of less than 0.30 perms when tested per ASTM E96.

3. Vapor Barrier shall be installed under concrete slabs of all habitable spaces. Barrier shall be installed per the manufacturer recommendations and per ASTM E1643.

I. Non-Waterstop Joint Material:

1. Preformed Joint Material: Preformed asphalt-impregnated fiber conforming to ASTM D1751.
2. Bond Breaker: All bond breakers shall be roofing felt or 15 mils minimum dry film thickness of bituminous paint as indicated.

2.08 CONCRETE DESIGN REQUIREMENTS:

- A. General: Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. The exact proportions in which these materials are to be used for different parts of the WORK will be determined during the trial batch process. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results. All changes shall be subject to review by the DISTRICT.

B. Fine Aggregate Composition:

1. In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight shall be as indicated in the following table.

| Fine Aggregate | |
|-------------------------|------------------------|
| Fineness Modulus | Maximum Percent |
| 2.7 or less | 41 |
| 2.7 to 2.8 | 42 |
| 2.8 to 2.9 | 43 |
| 2.9 to 3.1 | 44 |

2. For other concrete, the maximum percentage of fine aggregate of total aggregate, by weight, shall not exceed 50.

- C. Structural silica fume concrete shall contain 10 percent silica fume by weight of cement.

- D. Structural chloride resistant concrete shall contain [4]-gallons per cubic yard corrosion inhibiting admixture and a high range water reducer. Workability or strength demands shall be met by additional admixtures, if necessary.

- E. Duct bank concrete shall contain an integral red-oxide coloring pigment. Concrete shall be dyed red throughout. Surface treatment to color duct banks will not be acceptable.

F. Water/Cement Ratio and Compressive Strength:

1. Water/cement ratio is given for aggregates in saturated-surface dry condition, and total moisture of all aggregates, calculated by ASTM C566, less the absorption of the aggregate as calculated by ASTM C127 and C128, shall represent total free moisture in the aggregate to determine the water/cement ratio. Total free moisture of aggregates shall be added to batch water to estimate water content of concrete. Concrete shall have the following minimum properties:

G. Concrete Proportions:

| Type of Work | Min 28-Day Compressive Strength (psi) | Maximum Size Aggregate (in) | * Cement Content per cubic yd (lbs) | * Maximum W/C Ratio (by weight) |
|---|---------------------------------------|-----------------------------|-------------------------------------|---------------------------------|
| Structural Concrete | | | | |
| Roof, floor slabs, columns, walls, and all other concrete items not indicated elsewhere. | 4,500 | 1 | 564 to 600 | 0.45 |
| 12-inch and thicker walls, slabs on grade, and footings (optional) | 4,500 | 1-1/2 | 564 to 600 | 0.45 |
| [Structural silica fume concrete | 6000 | 1 | 564 to 600 | 0.38 |
| [Structural chloride resistant concrete | 5000 | 1 | 658 to 694 | 0.38 |
| [Tremie Concrete] | 4000 | 3/4 | 658 minimum | 0.45 |
| Pea Gravel Concrete | | | | |
| Thin sections and areas with congested reinforcing, at the CONTRACTOR'S option and with the written approval of the DISTRICT for the specific location. | 4,500 | 3/8 | 752 to 788 | 0.40 |
| Sitework concrete | [3,500] | [1] | [470 (min)] | [0.50] |
| Lean concrete | 2,000 | 1 | 376 (min) | 0.60 |

* The cement content and water cement ratio are based on total cementitious material including silica fume, slag or flyash.

NOTE: The CONTRACTOR is cautioned that the limiting parameters above are not a mix design. Admixtures may be required to achieve workability required by the CONTRACTOR'S construction methods and aggregates. The CONTRACTOR is responsible for providing concrete with the required workability and strength.

- H. Adjustments to Mix Design: The CONTRACTOR may elect to decrease the water/cement ratio to achieve the strength and shrinkage requirements and/or add water reducers, as required to achieve workability. The mixes shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish, and the CONTRACTOR shall be entitled to no additional compensation because of such changes. Any changes to the accepted concrete mix design shall be submitted to the DISTRICT for review and shall be tested again in accordance with these Specifications.
- I. When using a floor hardener, the water/cement ratio shall not be greater than specified by the hardener manufacturer.

2.09 CONSISTENCY:

- A. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation and which can be

compacted by vibratory methods to give the desired density, impermeability, and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C143. The slumps shall be as follows:

2.10 MEASUREMENT:

- A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the DISTRICT.
- B. Weighing tolerances:

| Material | Percent of Total Weight |
|-----------------|--------------------------------|
| Cement | 1 |
| Aggregates | 3 |
| Admixtures | 3 |

- C. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the DISTRICT and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any required amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism shall prevent leakage when the valves are closed.

PART 3 - EXECUTION

3.01 PROPORTIONING AND MIXING:

- A. Proportioning of the mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.
- B. Mixing shall conform to the requirements of Chapter 7 of ACI 301.
- C. Slumps shall be as indicated herein.
- D. Retempering of concrete or mortar that has partially hardened shall not be permitted.

3.02 PREPARATION OF SURFACES FOR CONCRETING:

- A. General: Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. Vapor Barrier
 - 1. Vapor Barrier shall be installed under on-grade building floor slabs of occupiable (non-hydraulic) structures and at other locations indicated.
 - 2. Base shall be leveled, compacted, and tamped per SECTION 02200 Earthwork. Remove sharp edges, projection materials and roughness that might penetrate vapor barrier. Install barrier with width parallel with the direction of the pour of the concrete.
 - 3. Place, protect, and repair defects in sheet according to ASTM E1643, and the manufacturer's written instructions. Seams shall be lapped and sealed in accordance with ASTM E1643.
 - 4. The CONTRACTOR shall exercise care to avoid puncturing or tearing the vapor barrier during installation. Patch punctures and tears as they occur.

C. Joints in Concrete:

1. All joints shall be installed where indicated on the Drawings or where otherwise approved by the DISTRICT. The surface of the construction joint shall be rough and prior to placement shall be cleaned and moistened with water.
2. Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the DISTRICT, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bonding. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and be roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. Pools of water shall be removed from the surface of construction joints before the new concrete is placed.
3. After the surfaces have been prepared, all approximately horizontal construction joints shall be covered with a 6-inch lift of a pea gravel mix. The mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix. If high range water reducer is used in the wall concrete, then the pea gravel joint topping does not need to be used.

D. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the DISTRICT.

E. Embedded Items:

1. No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the DISTRICT at least 4 hours before placement of concrete. Surfaces of forms and embedded items that have become encrusted with dried grout from previous usage shall be cleaned before the surrounding or adjacent concrete is placed.
2. Inserts or other embedded items shall conform to the requirements herein.
3. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations indicated on the Drawings or shown by Shop Drawings and shall be acceptable to the DISTRICT before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

F. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydroblasting or sandblasting to expose aggregate. The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the DISTRICT.

G. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the WORK. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be subject to the review of the DISTRICT.

H. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete

reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

- I. Openings for pipes, inserts for pipe hangers and brackets, and anchors shall, where practicable, be provided during the placing of concrete.
- J. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.
- K. Cleaning: The surfaces of metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.03 CONVEYING:

- A. Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent separation or loss of material.
- B. No aluminum materials shall be used in conveying any concrete.
- C. Ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting, and placing system shall be designed and arranged so that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the DISTRICT. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.
- D. Pumping:
 - 1. If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
 - 2. The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the Site during pumping.
 - 3. The minimum diameter of the hose conduits shall be in accordance with ACI 304.
 - 4. Pumping equipment and hose conduits that are not functioning properly shall be replaced.
 - 5. Aluminum conduits for conveying the concrete shall not be permitted.
 - 6. Concrete samples for slump, air content, and test cylinders will be taken at the placement end of the hose.

3.04 DELIVERY:

- A. Ready-mixed concrete shall be batched, mixed, transported and delivered in accordance with these specifications and ASTM C94 including the following supplementary requirements.
 - 1. Concrete shall be discharged within [1-1/2] hours from the time concrete was mixed, if centrally mixed, or from the time the original water was added, if transit-mixed, or before the drum has been revolved [300] revolutions, whichever is first.
 - 2. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one-inch when the required slump is 3-inches or

less, or if they differ by more than 2-inches when the required slump is more than 3-inches, the mixer shall not be used on the WORK unless the causative condition is corrected and satisfactory performance is verified by additional slump tests. Mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

3. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the DISTRICT.
4. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

3.05 PLACING:

- A. Non-Conforming Work or Materials: Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the WORK. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced.
- B. Unauthorized Placement: No concrete shall be placed except in the presence of a duly authorized representative of the DISTRICT. The CONTRACTOR shall notify the DISTRICT in writing at least 24 hours in advance of placement of any concrete.
- C. Concrete shall not be dropped more than four feet (4') without use of chutes or tremies. Concreting shall be a continuous operation until placement of the section is complete. All concrete shall be worked around reinforcement and embedded items. If vibrators are used, care shall be taken not to segregate concrete. Vibrators will not be allowed to move concrete within the form. All forms and subgrade shall be dampened prior to placement and excess water removed.
- D. Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section.
- E. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.
- F. Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, means such as hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6-feet in horizontal direction. Concrete in wall forms shall be deposited in uniform horizontal layers not deeper than 2-feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in wall forms shall not exceed 5-feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.
- G. Concrete with hardener shall be placed per the hardener manufacturers written recommendations.

- H. Casting New Concrete Against Old: Epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is provided, see SECTION 03100 Concrete Formwork.
- I. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F or less than 55 degrees F for sections less than 12-inches thick, nor less than 50 degrees for all other sections. The CONTRACTOR shall be entitled to no additional compensation on account of the temperature requirements.
- J. Hot Weather Placement
 - 1. Placement of concrete in hot weather shall conform to ACI 305 and the following:
 - 2. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed [60] minutes.
 - 3. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as pre-cooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete below 90 degrees F as it is placed.
- K. Cold Weather Placement
 - 1. Placement of concrete in cold weather shall conform to ACI 306.1, and the following:
 - 2. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the minimum temperature.
 - 3. Remove all snow, ice, and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6-inches. Reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.
 - 4. Maintain the concrete temperature above 50 degrees F for at least 72 hours after placement.
- L. Order of Placing Concrete
 - 1. The order of placing concrete in all parts of the WORK shall be acceptable to the DISTRICT. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints at the indicated locations. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 5 days for hydraulic structures and 2 days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 10 days for hydraulic structures and 4 days for all other structures.
 - 2. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and laitance shall be removed.

3.06 TAMPING AND VIBRATING:

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete. Vibrators shall be Group 3 per ACI 309, high speed power vibrators (8,000 to 12,000 rpm) of an immersion type in sufficient

number and with at least one standby unit as required. Group 2 vibrators may be used only at specific locations when accepted by the DISTRICT. [Tremie concrete shall not be vibrated.]

- B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.
- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the required results within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall not contact the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.07 **CURING AND DAMPPROOFING:** Concrete shall be cured for a minimum of five (5) days after placement in accordance with the methods indicated below for the different parts of the WORK.

| Surface to be Cured or Dampproofed | Method |
|--|---|
| Unstripped forms | 1 |
| Wall sections with forms removed | 6 |
| Construction joints between footings and walls, and between floor slab and columns | 2 |
| Encasement and ductbank concrete and thrust blocks | 3 |
| All concrete surfaces not specifically indicated in this Paragraph | 4 |
| Floor slabs on grade in hydraulic structures | 5 |
| Slabs on grade to receive an adhered floor finish | 6 (Omit curing compound) |
| Slabs not on grade | 6 |
| Silica Fume Concrete | 7 |
| Concrete with hardener | Per manufacture's written recommendations |
| Tremie Concrete | 8 |

- A. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removal. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 7 days of placing the concrete, curing shall be continued in accordance with Method 6 below.
- B. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.
- C. Method 3: The surface shall be covered with moist earth not less than 4 hours or more than 24 hours after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
- D. Method 4: The surface shall be sprayed with a liquid curing compound.
 - 1. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film that will seal thoroughly.

2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the 7-day curing period. If the seal is damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
3. Wherever curing compound has been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
4. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces and within 2 hours after removal of forms. Repairs to formed surfaces shall be made within the 2 hour period; provided, however, that any such repairs which cannot be made within the said 2 hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound.
5. At locations where concrete is placed adjacent to a panel which has been coated with curing compound, the panel shall have curing compound reapplied to an area within 6-feet of the joint and to any other location where the curing membrane has been disturbed.
6. Prior to final acceptance of the WORK, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage the surface finish.

E. Method 5:

1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4 above. Not less than one hour or more than 4 hours after the curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting, or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3-inches and fastened together with a waterproof cement to form a continuous watertight joint.
2. The curing blankets shall be left in place during the 7-day curing period and shall not be removed until after concrete for adjacent work has been placed. If the curing blankets become torn or otherwise ineffective, the CONTRACTOR shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The CONTRACTOR shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

F. Method 6: This method applies to both walls and slabs.

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 7 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.
2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.
3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held substantially in contact with the concrete surface to prevent being dislodged by wind or any other causes. Edges shall be continuously held in place.

4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.
 5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, the entire concrete surface shall be wetted, and curing compound shall be immediately applied to the entire surface in accordance with Method 4 above.
 6. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the WORK.
- G. Method 7: This method applies to concrete containing silica fume for walls and slabs and shall be used in addition to the curing methods 1 through 6, and shall be concluded within one-hour of concrete placing.
1. In addition to the requirements of Method 1 for unstripped forms, and Method 6 for walls after the forms are removed, and Method 4 for slabs, wall surfaces after the forms are removed and slab surfaces shall be coated with two coats of a white pigmented curing compound as indicated in Method 4 above. A second coat of white pigmented curing compound shall be applied to the concrete surface at 7 days after the application of the initial coats. In addition, prewetted burlap shall be placed over the flatwork surface and kept continuously wet for a minimum of 7 days or until the time necessary to attain 70 percent of the required compressive strength in accordance with ACI 308 Section 3.1.3.
- H. Damp proofing
1. The exterior surfaces of backfilled dry well walls and buried roof slabs shall be damp proofed as follows.
 2. Immediately after completion of curing the surface shall be sprayed with a damp proofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to one-half strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the undiluted material, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Damp proofing material shall be as indicated above.
 3. As soon as the material has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used if it produces a uniformly coated white surface and remains until placing of the backfill. If the whitewash fails to remain on the surface until the backfill is placed, the CONTRACTOR shall apply additional whitewash.

3.08 CONCRETE FINISHES:

- A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are defined as tolerances and are indicated herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.
- B. Formed Surfaces:
1. No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated.
- C. Unformed Surfaces:

After proper and adequate vibration and tamping, unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks. Fog nozzles are required for slabs containing silica fume admixtures. The classes of finish for unformed concrete surfaces are designated and defined as follows:

Unformed Surface Finish Schedule

| Area | Finish |
|--|--------|
| Grade slabs and foundations to be covered with concrete or fill material | U1 |
| Floors to be covered with grouted tile or topping grout | U2 |
| Water bearing slabs with slopes 10 percent and less | U3 |
| Water bearing slabs with slopes greater than 10 percent | U4 |
| Slabs not water bearing | U4 |
| Slabs to be covered with built-up roofing | U2 |
| Interior slabs and floors to receive architectural finish | U3 |
| Top surface of walls subject to foot traffic | U4 |
| Top surface of walls not subject to foot traffic | U3 |
| Floors to receive surface hardener | U5 |

1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
2. Finish U2 - (Float Finish)
 - a. Compact, accurately screed and float to a true uniform surface.
 - b. Surfaces shall be floated with wood or metal floats or a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted.
 - c. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Test surface with straightedge and eliminate high and low spots of more than 1/8 inch in 10 feet. Surface irregularities shall not exceed 1/4-inch.
 - d. Joints and edges shall be tooled where indicated or as determined by the DISTRICT.
3. Finish U3 - (Hand-Troweled Finish)
 - a. Finish surface as in Finish U2 - Float Finish and after the surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, trowel with steel trowel to obtain a smooth dense finish after concrete has hardened to ring under the trowel.
 - b. The finish shall produce a smooth dense uniform surface free of all irregularities, blemishes, ripples, and trowel marks.
4. Finish U4 - (Nonskid Finish)
 - a. Trowel the Finish U3 - Hand-trowel Finish surface to remove local depressions or high points. In addition, the surface shall be given a light broom finish with brooming perpendicular to drainage unless otherwise indicated.
 - b. The resulting surface shall be rough enough to provide a nonskid finish.
5. Finish U5 - (Surface hardener)
 - a. Immediately after screeding, shake on hardener shall be applied per the manufacturer's written recommendations.

- b. Surface shall receive a minimum of two coats of a liquid hardener per the manufacturer's written recommendations.
- c. CONTRACTOR shall notify hardener manufacturer three (3) working days prior to hardened concrete floor being placed.
- d. Hardener manufacturer shall provide continuous supervision of concrete and hardener placements, supplying DISTRICT with a report of each day's placement. Cost of supervision is to be borne by CONTRACTOR.

3.09 ARCHITECTURAL FINISH:

- A. General: Architectural finishes shall be provided only where specifically indicated below. In all other locations, the paragraph entitled Concrete Finishes shall apply.

| Location | Finish |
|----------|--------|
| | |

- B. Immediately after the forms have been stripped, the concrete surface shall be inspected and any poor joints, voids, rock pockets, or other defective areas shall be repaired and form-tie holes filled as indicated herein.
- C. Architectural finishes shall not be applied until the concrete surface has been repaired as required and the concrete has cured at least 14 days.
- D. Architecturally treated concrete surfaces shall conform to the accepted sample in texture, color, and quality. It shall be the CONTRACTOR'S responsibility to maintain and protect the concrete finish.

3.10 PROTECTION:

- A. The CONTRACTOR shall protect concrete against injury until final acceptance.
- B. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

3.11 DEFECTIVE SURFACE TREATMENTS:

- A. Patching Concrete:
 - 1. Patch all tie holes, honeycombs or other defects with a Portland Cement and sand grout.
 - 2. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, plus not less than 1/32-inch depth of the surface film from all hard portions by means of an efficient sandblast.
 - 3. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends.
 - 4. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. Holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section and other imperfections having a depth greater than their least surface dimension shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

5. The grout shall not be richer than one (1) part cement and three (3) parts sand with the amount of mixing water enough to produce a workable mix. For exposed walls, the cement shall contain such a proportion of white Portland cement as is required to make the color of the patch match the color of the surrounding concrete. The patch shall be finished in such a manner as to match the adjoining surfaces.
6. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

B. Defective Concrete:

1. Any concrete which is not formed as shown on the Drawings or does not conform to the Contract tolerances or shows defects which reduce its structural adequacy, shall be removed from the job by the CONTRACTOR at his expense unless the DISTRICT grants permission to patch the defective area.

C. Exposed Concrete Surfaces:

1. As soon as forms are removed, exposed surfaces shall be carefully examined and all ridges, ribs and other imperfections shall be rubbed with an abrasive stone or ground in a satisfactory manner in order to secure a smooth, uniform and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted
2. No repairs shall be made until after inspection by the DISTRICT.
3. In no case will extensive patching of honeycombed concrete be permitted
4. Concrete containing minor voids, pinholes, honeycombing, or similar depression defects shall be repaired as indicated below.
5. Concrete containing extensive voids, holes, honeycombing, or similar depression defects shall be completely removed and replaced. Repairs and replacements shall be performed promptly.

3.12 **REINFORCEMENT:** Reinforcement shall be in accordance with SECTION 03200 Concrete Reinforcement, of these Specifications. Concrete protection for the reinforcement shall conform to the requirements ACI 318, paragraph 7.7.1.

3.13 **CONSTRUCTION TOLERANCES:**

- A. The CONTRACTOR shall set and maintain concrete forms and perform finishing operations to ensure that the completed WORK is within tolerances. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the Drawings. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.
- B. The following non-cumulative construction tolerances apply to finished walls and slab unless otherwise indicated:

| Item | Tolerance |
|--|---|
| Variation of the constructed linear outline from the established position in plan. | In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch |
| Variation from the level or from the grades indicated. | In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch |
| Variation from plumb | In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch |
| Variation in the thickness of slabs and walls. | Minus 1/4-inch; Plus 1/2-inch |
| Variation in the locations and sizes of slabs and wall | Plus or minus 1/4-inch |

| | |
|----------|--|
| openings | |
|----------|--|

3.14 CARE AND REPAIR OF CONCRETE:

- A. The CONTRACTOR shall protect concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed WORK, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete.

END OF SECTION

SECTION 03600 GROUT

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONTRACTOR shall furnish all equipment, labor and material for the proper placement and curing of grout as indicated on the Drawings and as specified herein.
 - 1. SECTION 03100 - Concrete Formwork and Accessories
 - 2. SECTION 03300 - Cast-in-Place Concrete

1.02 APPLICABLE PUBLICATIONS: The following standard specifications shall apply to the WORK of this SECTION:

- A. American Society of Testing and Materials (ASTM)
 - 1. C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars
 - 2. C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
 - 3. C496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
 - 4. C531 - Test Method for Linear Shrinkable and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing
 - 5. C579 - Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacing and Polymer Concretes
 - 6. C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - 7. C827 - Test Method for Early Volume Change of Cementitious Mixtures
 - 8. C881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 - 9. C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
 - 10. C939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
 - 11. C1090 - Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout
 - 12. C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)
 - 13. C1339 - Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts
 - 14. D648 - Test Method for Deflection Temperature of Plastics Under Flexural Load
 - 15. D695 - Test Method for Compressive Properties of Rigid Plastics
- B. International Concrete Repair Institute (ICRI)
 - 1. Technical Guide for Selecting and Specifying Concrete Surface preparation for Sealers, Coatings, and Polymer Overlays
- C. American Institute of Steel Construction (AISC)
 - 1. Manual of Steel Construction
- D. American Concrete Institute (ACI)
 - 1. Building Code Requirements for Structural Concrete (ACI 318, latest edition)
- E. International Code Council (ICC), formerly the International Conference of Building Officials (ICBO)

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS: The CONTRACTOR shall submit the following:

- A. MANUFACTURER's literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use.
- B. Name and telephone number of grout MANUFACTURER's representative, who will give on-site job service. The representative shall have at least one (1) year of experience with the chosen grouts.

1.05 QUALIFICATIONS:

- A. Pre-installation Demonstration and Training:
 - 1. The grout MANUFACTURER shall give a demonstration and training session for all the cement based non-shrink and epoxy grouts to be used on the Project, before any installation of grout is allowed.
 - 2. Training session shall use a minimum of five (5) bags of Cement Based Non-Shrink Class I Grout mixed to fluid consistency. Tests shall be conducted for flow cone and bleed tests. Six cubes for testing at 1, 3, and 28 days shall be made. The remaining grout shall be placed, and curing initiated on actual project placements such as baseplates and tie holes to provide on-the-job training for the CONTRACTOR and DISTRICT. The CONTRACTOR shall have the employees who will be doing the actual WORK participate in this training and demonstration session. The training session shall include methods for curing the grout.
 - 3. The MANUFACTURER shall mix enough Cement Based Non-Shrink Class II Grout for a minimum of fifteen (15) tie holes and shall train the CONTRACTOR's employees in how to perform the WORK and cure the grout. The CONTRACTOR shall have the employees assisting in the mixing and sealing of the tie holes.
 - 4. If the project includes patching, throughbolt holes, epoxy anchors, and/or blockouts, the MANUFACTURER shall also train the CONTRACTOR's employees in the mixing and curing of the epoxy grouts for each of these applications.
 - 5. The CONTRACTOR shall transport the test cubes to an independent test laboratory, obtain the test reports, and report these demonstration and training test cube strengths to the DISTRICT.
- B. Adhesive anchor installers shall be trained and qualified at the site by MANUFACTURER's representative before installing any adhesive anchors. Training and qualification for each installer shall include, but not be limited to:
 - 1. Anchors installed in both the vertical and horizontal positions in a mock-up concrete panel of adequate size and thickness. Anchors shall be tested in tension and shear loading. A minimum of three anchors shall be tested for each installation position.
 - 2. Anchors shall be tested at two times the published allowable load in tension and in shear as indicated by the AISC Manual of Steel Construction.
 - 3. If any of the three test bolts in any installation position fail to reach the test loads, the installer shall be re-tested with the same procedure. Re-testing is required only for the failed installation position.
 - 4. An installer who has three consecutive successful bolt tests in the first or second trial is considered qualified for adhesive anchor installation for this Project. The MANUFACTURER's representative shall issue a certificate to the qualified installer, and a copy of the certificate shall be filed with the CONTRACTOR and be submitted to the DISTRICT.
 - 5. The test anchor size shall be the maximum size adhesive anchor used on the Project. The embedment length shall be long enough to develop the allowable steel strength per AISC Manual of Steel Construction and ACI 318, Appendix D.
 - 6. Each installer shall be re-qualified every six months for the duration of the Project, by the same qualifying procedure.
 - 7. The certification of each qualified installer shall be available for verification at the Special Inspector's request.
 - 8. All defective anchors noted by the Special Inspector shall be replaced and re-installed by the CONTRACTOR without any additional compensation.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall assist the DISTRICT in obtaining specimens for testing and shall furnish all materials necessary for fabricating the test specimens.
- B. The cost of laboratory tests on grout will be paid by the DISTRICT except where test results show the grout to be defective. In such case, the CONTRACTOR shall pay for the tests, removal and replacement of defective WORK, and re-testing all at no increased cost to the DISTRICT.
- C. The MANUFACTURER of prepackaged grouts shall provide on-site technical assistance within 72 hours of request at no cost to the DISTRICT.

1.07 CERTIFICATIONS AND TESTING: The CONTRACTOR shall provide to the DISTRICT three (3) copies of certified test results for all tests required herein.

- A. Test results and service report from the field tests and the demonstration and training session verifying the requirements indicated herein.
- B. Certification that all grout used on the project contains no chlorides or other chemicals that cause corrosion.
- C. MANUFACTURER's certification that their non-shrink grout does not contain aluminum, zinc, or magnesium powders, used as a method of expansion.
- D. ICC certifications for all adhesive anchors.

1.08 INSPECTION COORDINATION:

- A. All adhesive anchor installations shall have special inspections as recommended by the ICC report on the adhesive anchors and local codes.

1.09 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 APPLICATION:

- A. Unless indicated otherwise, grouts shall be provided as listed below whether indicated on the Drawings or not:

| TYPE OF GROUT | APPLICATION |
|-----------------------|--|
| Cement Grout | Surface repairs |
| Non-Shrink - Class I | All anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F, or in high fire risk areas. |
| | Beam and column (1 or 2 story) base plates less than 16 inches in the least dimension. |
| | Storage tanks and other non-motorized equipment and machinery under 30 horsepower |
| | Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc. (Where placement time is less than 20 min.) |
| | Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material |
| | Any application not listed, where grout is called for on the Drawings |
| Non-Shrink - Class II | Column base plates (greater than 2 story or larger than sixteen (16) inches in the least dimension) |

| TYPE OF GROUT | APPLICATION |
|-------------------------------|---|
| | Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc. (where placement time exceeds 20min.) |
| | Under precast concrete elements |
| | Repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials |
| Non-Shrink Epoxy | Machinery over 30 horsepower and equipment under 30 horsepower but subject to severe shock loads and high vibration |
| Epoxy Anchor Grout | All anchor bolts and reinforcing steel required to be set in grout that are not in high temperature or high fire risk areas. |
| Topping Grout | Toppings and concrete/grout fill less than three (3) inches thick |
| Structural Concrete per 03300 | Toppings and concrete/grout fill greater than three (3) inches thick |

2.02 MATERIALS:

A. Cement Grout:

1. Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi, unless indicated otherwise.
2. Cement grout materials shall be as indicated in SECTION 03300 – Cast-in-Place Concrete.

B. Non-Shrink Grouts (Cement Based):

1. General:

- a. Cement Based Non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas-liberating, non-ferrous, grout, requiring only the addition of water.
- b. MANUFACTURER's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout indicated herein shall be that recommended by the MANUFACTURER for the particular application.
- c. Grout shall not contain chlorides or additives, which may contribute to corrosion.
- d. Grout shall be formulated to be used at any consistency from fluid to plastic.
- e. Non-Shrink grout shall have the following minimum properties when tested at a fluid consistency at 28 days:

| | | |
|-----------------------------------|--------------------|------------------|
| Tensile Splitting Strength | ASTM C496 | 500 psi minimum |
| Flexural Strength | ASTM C580 | 1000 psi minimum |
| Bond Strength (concrete to grout) | ASTM C882 modified | 1900 psi minimum |

- f. Grout shall be certified for use in marine environments

2. Class I Non-Shrink Grout:

- a. Class I Non-Shrink Grout shall have a minimum 28-day compressive strength of 5000 psi, when mixed at a fluid consistency.
- b. Class I Non-Shrink grout shall meet the requirements of ASTM C1107, Grade B or C, when mixed to fluid, flowable and plastic consistencies.
- c. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827. The grout when tested shall not bleed or segregate at maximum allowed water.

- d. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C1090.
 - e. Provide certification together with independent test data that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas production or gypsum expansion.
3. Class II Non-Shrink Grout:
- a. Class II Non-Shrink grout shall be a high precision, fluid, extended working time grout. The minimum 28-day compressive strength shall be 7500 psi, when mixed at a fluid consistency.
 - b. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827.
 - c. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C1090.
 - d. Class II grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C1107.
 - e. Class II Non-Shrink grouts shall meet the requirements of ASTM C1107; Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C939.
 - f. The grout when tested shall not bleed or segregate at maximum allowed water.
 - g. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.

C. Non-Shrink Epoxy Grout:

- 1. Non-Shrink Epoxy grout shall be a flowable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the MANUFACTURER. MANUFACTURER's instructions shall be printed on each container in which the materials are packaged.
- 2. Epoxy grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827, (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).
- 3. Epoxy grout shall have a negligible (less than 0.0006 in/in) length change after hardening, and a coefficient of thermal expansion less than 0.00003 in/in F when tested according to ASTM C531.
- 4. The epoxy grout shall develop a minimum compressive strength of 9000 psi in 24 hours and 13,000 psi in seven days when tested in accordance with ASTM C579, method B.
- 5. The mixed epoxy grout shall have a minimum working life of 90 to 120 minutes at 70 degrees F.
- 6. The effective bearing area shall be a minimum of 95% EBA in accordance with ASTM C1339.
- 7. The chemical formulation of the epoxy grout shall be that recommended by the MANUFACTURER for the particular application. Do not reduce aggregate loading or add solvents to increase flowability.
- 8. Non-Shrink Epoxy grout shall have the following minimum properties when tested at 7 days:

| | | |
|---------------------------|--------------------|------------------|
| Bond Strength to Concrete | ASTM C882 modified | 3000 psi minimum |
| Bond Strength to Steel | ASTM C882 modified | 1700 psi minimum |
| Flexural Strength | ASTM C580 | 2500 psi minimum |
| Tensile Strength | ASTM C307 | 2000 psi minimum |

D. Epoxy Anchor Grout:

1. Epoxy anchor grout shall be a non-sag paste conforming to ASTM C881 Type IV, A, B and C Grade 3 with the exception of gel time.
2. Heat deflection temperature per ASTM D648 shall be a minimum 120 degrees F.
3. MANUFACTURER shall certify that the epoxy grout will maintain 90 percent of its strength up to a temperature of 125 degrees F.
4. Grout shall come in a two-chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.
5. Epoxy anchor grout shall be capable of being used in submersed applications once cured.
6. Compressive strength per ASTM D695 shall be 10,000-psi minimum.
7. In vertical and overhead locations, anchor seal plugs shall be used.
8. If the average working or operating temperature will be over 100° F or in a high fire risk area, use cement based non-shrink grout and oversized holes.
9. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar. Embedment shall not exceed 67% of the member depth.

E. Topping Grout and Concrete/Grout Fill:

1. Where fill is thicker than 3 inches, structural concrete, as specified in SECTION 03300, may be used if approved by the DISTRICT.
2. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and procedures indicated for normal concrete in SECTION 03300, shall apply unless indicated otherwise.
3. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45.
4. Coarse aggregate shall be graded as follows:

| U.S. STANDARD SIEVE SIZE | PERCENT BY WEIGHT PASSING |
|--------------------------|---------------------------|
| 1/2" | 100 |
| 3/8" | 90-100 |
| No. 4 | 20-55 |
| No. 8 | 5-30 |
| No. 16 | 0-10 |
| No. 30 | 0 |

5. Final mix design shall be as determined by trial mix design as indicated in SECTION 03300, except that drying shrinkage tests are not required.
6. Strength: Minimum compressive strength of topping grout and concrete/grout fill at 28 days shall be 4000 psi.

2.03 CURING: Curing materials shall be as specified in SECTION 03300, and as recommended by the MANUFACTURER of prepackaged grouts.

2.04 CONSISTENCY:

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.
- B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.05 MEASUREMENT OF INGREDIENTS:

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurements shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the MANUFACTURER.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the DISTRICT.
- B. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of saturation period excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.
- C. Surface preparation, curing, and protection of cement grout shall be in accordance with SECTION 03300. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.
- D. All surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete or other deleterious materials.
- E. Shade the WORK sites from sunlight for at least 24 hours before and 48 hours after grouting.
- F. Contact the grout MANUFACTURER's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.02 GROUTING PROCEDURES:

- A. General: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the MANUFACTURER.
- B. All structural, equipment, tanks, and piping support bases shall be grouted, unless indicated otherwise.
 - 1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout, or a thickness as indicated on the Drawings.
 - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against all surfaces, and joints shall be sealed as recommended by the grout MANUFACTURER to be liquid-tight. Forms shall be coated as recommended by the grout MANUFACTURER for easy form release. Where this method of placement is not practical or where required by the DISTRICT, alternate grouting methods shall be submitted for acceptance by the DISTRICT.
- C. Drilled anchors and Reinforcing Bars:
 - 1. General: Drilled anchors and reinforcing bars shall be installed in strict accordance with the MANUFACTURER's instructions. Holes shall be roughened with a brush on a power drill, and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28-day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the MANUFACTURER's instructions.
 - 2. Epoxy Adhesive Anchors:
 - a. Grout shall be proportioned and mixed with automatic equipment.

- b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the AISC Manual of Steel Construction and ACI 318, Appendix D., but shall not be less than eight (8) diameters for threaded rod, or 12 diameters for reinforcing or smooth bars.
 - c. The hole diameter shall be as recommended by the epoxy MANUFACTURER but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the bolt threads or the reinforcing bar deformations.
 - d. Holes shall be drilled by methods that do not interfere with the proper bonding of the epoxy.
 - e. Existing reinforcing steel in the vicinity of the proposed holes shall be located prior to drilling. The location of holes shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
 - f. Holes shall be blown clean with clean, dry compressed air to remove all dust and loose particles. Holes shall be dry.
 - g. Reinforcing bars and anchors shall be installed per the MANUFACTURER's written installation instructions.
3. Cement Based Non-Shrink Grout:
- a. In places of high temperature or fire hazard, anchor bolts shall be grouted in using Cement Based Non-Shrink Grout, Class I.
 - b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the AISC Manual of Steel Construction and ACI 318, Appendix D., but shall not be less than sixteen (16) diameters for threaded rod, or 24 diameters for reinforcing or smooth bars.
 - c. When the bolt diameter is one inch or less, the hole diameter should be a minimum of two inches. When the bolt's diameter is greater than one inch, the hole diameter should be at least twice the bolt diameter.
 - d. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.
 - e. The non-shrink grout should be placed in the holes in a non-sag (trowellable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.
- D. Topping Grout and Concrete/Grout Fill:
- 1. All mechanical, electrical, and finish WORK shall be completed prior to placement of topping or concrete/grout fill. To ensure bonding to the base slab, the base slab shall be given an exposed aggregate finish. Alternatively where accepted by the DISTRICT, the base slab shall be given a roughened textured surface by a close-spaced rake while the surface is green. After curing, high pressure washing shall expose the aggregates and produce not less than a 3/16-inch amplitude roughness. Jackhammers or chipping hammers shall not be used.
 - 2. The minimum thickness of grout topping and concrete/grout fill shall be one inch. Where the finished surface of concrete/grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.
 - 3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry (SSD) condition per International Concrete Repair Institute Standards for Surface Preparations, prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat cement grout shall be broomed into the surface of the slab just before topping or fill placement. The neat cement grout shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill shall be compacted by rolling or thorough tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the

revolving mechanism of the equipment in accordance with the procedures outlined by the equipment MANUFACTURER after the grout is brought to the established grade. Coat surface with evaporation retardant as needed to prevent plastic shrinkage cracks.

4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots, which shall be immediately eliminated. When the topping and/or fill have hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.
6. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by the DISTRICT, the tank shall be filled with sufficient water to cover the entire floor for fourteen (14) days.

3.03 CONSOLIDATION:

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

3.04 CURING:

- A. Cement based grouts shall be cured per SECTION 03300 and per the MANUFACTURER's recommendations.

3.05 FIELD TESTING:

- A. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the DISTRICT to ensure continued compliance with these specifications. The specimens will be made by the DISTRICT or its representative.
- B. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C109 (Using 2-in or 50mm Cube Specimens), at intervals during construction selected by the DISTRICT. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
- C. Compression tests and fabrication of specimens for topping grout, and concrete/grout fill will be performed as specified in SECTION 03300, at intervals during construction as selected by the DISTRICT.
- D. All material, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.
- E. The cost of all laboratory tests on mortar and grout will be borne by the DISTRICT, but the CONTRACTOR shall assist the DISTRICT in obtaining specimens for testing. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on WORK performed which does not meet the specifications. The CONTRACTOR shall provide all services necessary to conduct the compression tests.
- F. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C579, Method B, at intervals during construction as selected by the DISTRICT. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.

3.06 CONSTRUCTION TOLERANCES:

- A. Construction tolerances shall be as indicated in SECTION 03300, unless indicated otherwise.

END OF SECTION

SECTION 05060 WELDING

PART 1 - GENERAL

1.01 SCOPE: The CONTRACTOR shall provide all labor, equipment, and materials for all shop and field welding as required by the Drawings and/or Specifications.

1. SECTION 05070 - Bolted Fasteners
2. SECTION 05100 - Structural Steel

1.02 SHOP DRAWINGS AND ERECTION PROCEDURES:

A. Drawing shall include all shop and erection details, including welds. All welds, both shop and field, shall be indicated by standard welding symbols as noted by American Welding Society (AWS) A2.0. Drawings shall show the size, length and type of each weld.

1.03 STANDARD REFERENCES: The following standard specifications shall apply to the WORK of this SECTION as indicated:

- A. American Welding Society, Structural Welding Code, (AWS)
- B. American Institute of Steel Construction Manual for Steel Construction, 9th Edition, (AISC)
- C. American Society for Testing and Materials (ASTM)
- D. American Welding Society:
 1. D1.1 - Code for Welding in Building Construction
- E. Welding shall be in accordance with American Welding Society Standard Code D1.1.

1.04 WELDERS QUALIFICATIONS: All welders, including tack welders, shall be qualified in accordance with Section 5, Part C of AWS D1.1. The CONTRACTOR shall certify by name, to the DISTRICT, the welders so qualified including the code and procedures under which the individual qualified.

- A. Welders and Welding Operators, shop and field, shall be qualified by an independent laboratory using test procedures covered by an independent laboratory using test procedures covered in AWS D1.1, and shall have been employed as a welder using the positions for which he is qualified during the previous 90 days. The CONTRACTOR shall provide the DISTRICT and the laboratory inspector with the names of welders to be employed in the shop and field on the WORK, certification of the position, date of the last qualification test and the name of the qualifying laboratory.
 1. All welders employed in the shop on the fabrication of the steel work shall be qualified for the most difficult welding position during shop fabrication.
 2. All welders employed in the field on the erection of the steel work shall be qualified for the most difficult welding position during field erection.
 3. The CONTRACTOR shall require any welder to retake the test, when, in the opinion of the DISTRICT, the WORK of the welder creates a reasonable doubt as to the proficiency of the welder. Recertification of the welder shall be made to the DISTRICT only after the welder has taken and passed the specified test. The DISTRICT may require radiographic or ultrasonic testing or may require coupons to be cut from any location in any joint for testing.
 4. Should any two radiographic or ultrasonic tests or coupons cut from the work of any welder show strengths, under tests, less than that of the base metal, it will be considered evidence of negligence or incompetence and such welder shall be removed from the WORK.

5. When coupons are removed from any part of a structure, the members cut shall be repaired, at no additional cost to the DISTRICT, in a neat and workmanlike manner with joints of type to develop the full strength of the members and joints cut, with peening to relieve residual stress. All SECTIONS of welds found defective shall be chipped or cut out to base metal and rewelded before proceeding with the WORK.
6. Costs of all qualifications, tests and retests shall be borne by the CONTRACTOR.

1.05 INSPECTION AND TESTING:

- A. Shop inspections and tests shall include fit-up, preparation of surfaces and welding.
- B. Field inspections and tests shall include fit-up, preparation of surface and welding.

1.06 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - MATERIALS

2.01 WELD METAL: The chemical and mechanical properties of all deposited weld metal shall be compatible to the base metal and conform to AWS specifications for electrodes.

2.02 BASE METAL: The parent structural steel shall be a weldable grade with the chemical and mechanical properties to produce a sound and serviceable welded joint.

2.03 FABRICATION:

- A. Surfaces of joints for welded and bolted connections shall be clean, bright metal.
 1. Welded connections will be permitted only where indicated on the drawings. Welded construction shall conform to the AISC and AWS Specifications.

PART 3 - EXECUTION

3.01 WELDING METHODS: Unless otherwise approved by the DISTRICT, welding of steel shall be by an electric arc welding process and shall conform to AWS, Structural Welding Code, and the applicable sections of the AISC.

3.02 WELDING EQUIPMENT: Welding equipment shall be capable of providing the welding required by the drawings or specifications herein in accordance with the requirements of joint qualifications in AWS D1.1.

3.03 WELDING ELECTRODES:

- A. Electrodes and flux used for submerged arc welding shall be of the same manufacture. The flux shall be free of contamination from dirt, mill scale and foreign material. Fused flux used in welding shall not be reused. Bare electrodes and flux used in combination shall conform to the requirements of AWS D1.1.
- B. Electrodes for manual shielded metal-arc welding shall conform to AWS D1.1.

3.04 QUALIFIED WELDS: Only qualified welded joints shall be permitted in accordance with AWS, Structural Welding Code, and applicable sections of AISC.

3.05 PAINTING:

- A. After cleaning and connections are approved by the laboratory inspector, all surfaces to be welded shall be given a shop coat of primer. After erection, all field connections shall be cleaned.
- B. All connections, including welds and all abraded surfaces on the shop primer shall be painted to give one complete coat primer. Paint for field touch-up shall be the same paint used for the shop coat.

END OF SECTION

SECTION 05070 BOLTED FASTENERS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK of this SECTION consists of furnishing all labor, materials and equipment necessary for installation of bolted fasteners as shown on the Drawings.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 05060 - Welding
 - 2. SECTION 05100 - Structural Steel

1.02 SHOP DRAWINGS:

- A. Shop Drawings shall include bolted connections and the type, size and length of bolts including washers.

1.03 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society of Testing Materials (ASTM)
 - a. A36 – Standard Specification for Carbon Structural Steel
 - b. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - c. A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi (pounds per square inch) Tensile Strength
 - d. A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi (kips per square inch) Minimum Tensile Strength.
 - e. A490 – Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
 - f. A563 – Standard Specification for Carbon and Alloy Steel Nuts
 - g. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
 - 2. American National Standards Institute (ANSI)
 - a. B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
 - b. B18.2.2 - Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
 - c. B18.2.6 - Metric Fasteners for Use in Structural Applications
 - 3. American Institute of Steel Construction (AISC)
 - 4. Specifications for Structural Joints Using ASTM A325 or A490 bolts, approved April 1978, by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation

1.04 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

1.05 TEMPLATES:

- A. Templates shall be furnished by the Fabricator to the job, together with instructions for the setting of anchors, anchor bolts and bearing plates.

1.06 INSPECTION AND TESTING:

- A. Field inspections and tests shall include fit-up, preparation of surface and bolting.

PART 2 - MATERIALS

2.01 GENERAL

- A. All bolts, nuts and washers not designated stainless steel shall comply with ASTM F1554, Grade 105 A325, A307, F1554, A307 and A325 as applicable. Appropriate stainless steel connections shall be used for Aluminum.
- B. All threaded rods shall comply with ASTM F1554, Grade.

2.02 HIGH STRENGTH BOLTS:

- A. High strength bolts not designated stainless steel shall conform to the requirements of ASTM A325. The bolt dimensions shall conform to the current requirements of ANSI B18.2.6 for heavy hex structural bolts.

2.03 ALLOY STEEL BOLTS: Alloy steel bolts shall conform to the requirements of ASTM A490.

2.04 NUTS:

- A. Nut dimensions shall conform to ANSI B18.2.2 for heavy hex nuts.
- B. Nuts for bolts not designated stainless steel shall conform to ASTM A563.

2.05 WASHERS:

- A. Flat, circular and square washers for bolts not designated stainless steel shall conform to ASTM F436, Type 1.
- B. Compressible-washer type direct tension indicators for all connections shall conform to ASTM A959, Type 325.

2.06 TAMPER RESISTANT FASTENERS:

- A. Fasteners removable only by use of a special tool.

2.07 ANCHOR BOLTS:

- A. Anchor bolts for equipment and machinery, where permanently anchored into concrete, shall be stainless steel, unless otherwise shown. The diameter, length, and any bend dimensions shall be as required by the equipment or machinery MANUFACTURER. Unless otherwise required, use 3/4 inch minimum diameter and other geometry shown on the Drawings. Furnish a minimum of two (2) nuts and a washer of the same material for each bolt. Provide sleeves as required or as shown for location adjustment.

- B. Submerged use is defined as any connection to concrete from a point one (1) foot six (6) inches above the maximum water surface in a water-holding basin and any connection below that point.
- C. Anchor bolts for other uses to anchor fabricated metalwork or structural building, or structural frame components in areas of wet use or washdown areas shall be stainless steel. Furnish two (2) nuts and one (1) washer per bolt of the same material as the bolt, unless otherwise shown.

2.08 STAINLESS STEEL FASTENERS LUBRICANT (ANTI-SEIZING):

- A. Where stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners are used, the CONTRACTOR shall apply an anti-seizing lubricant to the threads prior to making up the connections. The lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper.

2.09 ANCHORING SYSTEMS FOR CONCRETE:

- A. Expansion (Wedge) Anchors:
 - 1. Expansion anchors shall not be used except in dry areas, unless otherwise indicated on the Drawings.
 - 2. Provide Type 304 stainless steel anchors; sizes as shown on the Drawings.
 - 3. Expansion anchors shall be: ITW Trubolt Wedge Anchors, manufactured by ITW Redhead, Michigan City, IN; Hilti Kwik Bolt 3, manufactured by Hilti Corporation, Tulsa, OK; Wej-It Anchors, manufactured by Wej-It Fastening Systems, Norwalk, CT; or DISTRICT approved equal.
 - 4. Provide ICC or other similar building code organization recommendations regarding safe allowable design loads.
- B. Adhesive Anchors:
 - 1. Adhesive anchors shall be used for anchoring metal components in damp, below grade or submerged locations and where indicated on the Drawings.
 - 2. Adhesive anchors shall be Hilti HIT-RE 500 epoxy anchoring system with Type 304 stainless steel threaded rod, nuts and washers, as manufactured by Hilti Corporation, Tulsa, OK, or DISTRICT approved equal.

2.10 BOLTS AND FASTENERS:

- A. Bolts and fasteners not permanently embedded in concrete, but located outdoors in areas subject to the weather; chemical handling areas; equipment rooms subject to drainage, leakage, and washdown; and in galleries and trenches, shall be Type 304 stainless steel as hereinbefore specified.
- B. Bolts for flanges of piping, valves, and other similar connections shall be as specified in other sections or as shown on the Drawings.

2.11 FABRICATION:

- A. Structural material shall be fabricated and assembled in the shop. Assembled pieces shall be taken apart for the removal of burrs and shavings produced by the reaming operation. Parts not connected in the shop shall be secured by bolts to prevent damage in shipment and handling.
- B. Surfaces of joints for bolted connections shall be clean, bright metal. Fit-up of the parts shall be inspected and approved by the laboratory inspector prior to making final connection.
 - 1. Holes for bolts shall be 1/16 inch larger than the diameter of the bolt.

2. ASTM A307 bolts transmitting shear shall be threaded to such a length that no more than one thread will be within the grip of the metal. The bolts shall be of the length that will extend through, but no more than 1/4 inch beyond the nut. Nuts shall be tightened while bolt heads are tapped with a hammer. Tightening shall progress outward from the center of the joint. Nuts shall be locked after final tightening.
3. Bolted connections using ASTM A325 bolts shall conform to the Specifications for Structural Joints using ASTM A325 or A490 bolts. Bolt threads shall be excluded from the shear planes of the contact surfaces between the connected parts and the bolts shall be tightened by the "Turn-of-Nut" method.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Fasteners shall be tightened in properly aligned holes to provide, when all fasteners in the joint are tight, at least the minimum tension required by AISC Specification for Bolted Connections. The turn-of-the-nut method shall be utilized for all high-strength bolts as defined by AISC Specification for Bolted Fasteners.
- B. Anchor Bolts:
 1. Anchor bolts and anchors shall be located and built into connecting work. All anchor bolts shall be accurately located and held in place with templates at the time the concrete is poured.
- C. Concrete Anchors:
 1. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength. An anchor shall not be installed closer than six (6) times its diameter to either an edge of the concrete or masonry, or to another anchor, unless specifically detailed otherwise on the Drawings. Install in strict accordance with MANUFACTURER's written instructions. Use MANUFACTURER's recommended drills and equipment.

3.02 REUSE:

- A. A490 bolts and galvanized A325 bolts shall not be reused. Other A325 bolts may be reused, if approved by the DISTRICT.

3.03 BOLTED PARTS:

- A. The slope of the bolted parts in contact with the bolt head and nut shall not exceed 1:20 with respect to a plane normal to the bolt axis. Holes shall be punched and reamed, or drilled, and shall have a diameter nominally 1/16 inch in excess of the nominal bolt diameter. Over-size, short slotted and long slotted holes shall conform to the requirements of AISC Specifications for Structural Joints.

3.04 GALVANIZING:

- A. The galvanizing of the bolts, nuts and washers shall conform to the requirements of ASTM A153.

END OF SECTION

SECTION 05100 STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SCOPE: The WORK of this SECTION shall consist of furnishing all the labor, materials, and equipment necessary for installation of structural steel as shown on the Drawings and as specified herein.

1. SECTION 05070 - Bolted Fasteners
2. SECTION 05060 - Welding

1.02 CONDITIONS OF THE CONTRACT APPLY:

1.03 SHOP DRAWINGS AND ERECTION PROCEDURES:

- A. Prepare and submit shop and erection plans covering all structural steel and related items. All dimensions for checking of structural steel details shall be shown on the Drawings.
- B. The CONTRACTOR shall be responsible for the conformation of all steel details to the typical and special details shown on the Drawings. All details, notes and schedules appearing on the Drawings, and giving information for the fabrication and erection of the structural steel and related items shall be shown also on the erection or Shop Drawings. Drawing shall include all shop and erection details, including cuts, copes, connections and holes.
- C. Prepare and submit, for information, two copies of a detailed erection procedure with the shop and erection drawings. The procedure shall include the sequence of erection with temporary staying and bracing. No copies of such procedures will be returned.

1.04 APPLICABLE SPECIFICATIONS AND CODES: The following specifications and codes form a part of this SECTION of these specifications:

- A. American Institute of Steel Construction (AISC) Publications, Eighth Edition, with Commentary
 1. Code of Standard Practice for Steel Buildings and Bridges
 2. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, with Commentary
 3. Manual of Steel Construction
- B. American Society for Testing and Materials (ASTM):
 1. A36 - Specifications for Structural Steel
 2. A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
 3. A500 – Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 4. A501 – Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
 5. A572 – Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
 6. A992 – Specification for Structural Steel Shapes
 7. E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction
- C. American Building Society (AWS)
 1. D1.1 Structural Welding Code - Steel

D. Unless otherwise indicated on the Drawings, the Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings of the American Institute of Steel Construction, hereafter designated AISC, shall govern structural steel WORK.

1.05 SUBSTITUTIONS OF SECTIONS: Substitutions of sections or modifications of details, or both, and the reasons therefore, shall be submitted with the Shop Drawings for approval. Approved substitutions, modifications, and changes in related portions of the WORK shall be coordinated by the CONTRACTOR and shall be accomplished at no additional cost to the DISTRICT.

1.06 RESPONSIBILITY FOR ERRORS: The CONTRACTOR shall be responsible for all errors of detailing, fabrication, and for correct fitting measurements in the field to verify or supplement dimensions shown on the Drawings and shall assume responsibility for fitting new WORK to existing WORK.

1.07 TEMPLATES: Templates shall be furnished by the Fabricator to the job, together with instructions for the setting of anchors, anchor bolts and bearing plates. The CONTRACTOR shall ascertain that the items are set during the progress of the WORK.

1.08 QUALIFICATION:

A. Fabrication Shop and Erection personnel shall have fabricated and erected projects of similar size and complexity for at least five (5) years.

B. Joint Qualification: All joints shall comply with AWS D1.1.

1.09 INSPECTION AND TESTING:

A. Inspections and tests shall be performed by an independent laboratory complying with ASTM E329. All material to be furnished shall be subject to inspections and tests in the shop and field.

B. Reports of shop and field inspections and testing shall be made by the laboratory on a weekly basis and submitted directly as follows: One (1) copy each to the DISTRICT, Inspector, Contractor, Fabricator and Erector.

1.10 WARRANTY:

A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL: Materials shall be of domestic manufacture, within trade tolerances, new, undamaged and without splices. Structural material, plain or fabricated, shall be stored above the ground upon platforms, skids or supports. Material shall be kept free of dirt, grease and foreign matter and shall be protected from corrosion.

2.02 STRUCTURAL STEEL:

A. Structural steel shall comply with ASTM A36, A53 Grade B, and A500 Grade B, A501, A572 Grade 50, and A992 as applicable. Refer to the Drawings for the locations of each type of structural steel.

B. The CONTRACTOR shall furnish two copies of all mill reports covering the chemical and physical properties of the steel used.

2.03 PAINT: Paint for both shop or primer coat and field touch-up shall be Tnemec Company, Incorporated's 99 Green Primer; Sherwin-Williams Company's Ken Kromik Metal Primer; or Pratt & Lambert Incorporated's Noxide #96 Red Primer. Paint shall be compatible with Sprayed Fireproofing Systems.

2.04 GROUT: Non-shrink grout beneath base and bearing plates shall be Five Star Grout by U.S. Grout Corp., SonogROUT by L. Sonneborn Inc., Horn Non-Metallic Grout by A.C. Horn Inc., or Non-Ferrous Non-Shrink Grout by the Burke Co.

2.05 FABRICATION:

- A. Structural material shall be fabricated and assembled in the shop. Assembled pieces shall be taken apart for the removal of burrs and shavings produced by the reaming operation. Parts not connected in the shop shall be secured by bolts to prevent damage in shipment and handling.
- B. Connections shall be as shown on the Drawings. Connections not indicated shall be made to conform to the AISC Specifications. One-sided or other types of eccentric connections will not be permitted except where shown on the plans. Fit-up of the parts shall be inspected and approved by the laboratory inspector prior to making final connection.
 - 1. Holes shall be cut, drilled or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be clean-cut without torn or ragged edges. Outside burrs resulting from drilling or reaming operation shall be removed
- C. Milled surfaces shall comply with the AISC Specifications and the Drawings.
- D. Allowance shall be made for draw in all tension bracing.

PART 3 - EXECUTION

3.01 STRUCTURAL STEEL:

- A. Splices and field connections shall be made as shown or noted on the Drawings. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the assembly and fitting of parts shall be reported immediately to the DISTRICT for directions as to method of correction. Corrections shall be made at no additional cost to the DISTRICT.
- B. Leveling plates shall not be used under base plates.
- C. Column bases and bearing plates shall be attached as shown on the Drawings. Plates shall be supported and aligned on steel wedges or shims. After the supported members have been plumbed and positioned and the anchor nuts tightened, the entire bearing area under the plate shall be dry-packed solidly with non-shrink grout. Wedges and shims shall be cut off flush with edge of column base and bearing plates, and shall be left in place.
- D. After assembly, the various members forming parts of a completed frame or structure shall be aligned and adjusted before being fastened. Tolerance shall conform to AISC. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled. As erection progresses, the WORK shall be fastened to take care of all dead load, wind and erection stresses. Splices will be permitted only where indicated on the Drawings. Erection bolts used in welded construction shall be tightened and left in place. Welding for re-drilling will not be permitted.
- E. Drift pins may be used only to bring together the several parts, and shall not be used in such manner as to distort or damage the metal.
- F. The use of a gas-cutting torch in the field for correcting fabrication errors is prohibited unless the DISTRICT has specifically approved such procedures for each case individually in writing.

3.02 PAINTING:

- A. All steel WORK shall be cleaned of loose mill scale, loose rust, accessible weld slag or flux deposit, dirt, and foreign matter. Solvent shall remove oil and grease deposits. No paint shall be applied when steel temperature is below the dew point of the atmosphere. Paint shall be mixed and no pigment shall remain on bottom of can.
- B. After cleaning and connections are approved by the laboratory inspector, all steel WORK except that to be encased in concrete, surfaces to be fireproofed, or surfaces to be welded or bolted shall be given a shop coat of primer. The primer shall be applied at a rate to provide a minimum dry film of two (2.0) mils. The primer shall be applied without holidays or paint runs.
- C. After erection, all field connections shall be cleaned. All connections, including welds and bolts, and all abraded surfaces on the shop primer shall be painted to give one complete coat primer. Paint for field touch-up shall be the same paint used for the shop coat.

END OF SECTION

SECTION 05120 STEEL

PART 1 - GENERAL

1.01 SCOPE: This SECTION includes fabrication and erection of the structural steel and other steel or metal items as defined in AISC Manual, Code of Standard Practices.

A. Related Work Specified Elsewhere:

1. SECTIONS – Division 1

1.02 REFERENCES:

A. Applicable Standards:

1. American Institute of Steel Construction (AISC):
 - a. Manual of Steel Construction
 - b. Quality Criteria and Inspection Standards
2. American Welding Society (AWS):
 - a. D1.1 - Structural Welding Code
 - b. QC1 - Standard Qualification and Certification of Welding Inspectors
3. American Society for Testing and Materials (ASTM):
 - a. A6 - General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use
 - b. A36 - Structural Steel
 - c. A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - d. A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - e. A307 - Carbon Steel Externally Threaded Standard Fasteners
 - f. A569 - Steel Carbon (0.15 Maximum Percent) Hot- Rolled Sheet and Strip, Commercial Quality
 - g. B695 - Coatings of Zinc Mechanically Deposited on Iron and Steel
 - h. F436 - Hardened Steel Washers
4. Steel Structures Painting Council (SSPC):
 - a. SP1 - Solvent Cleaning
 - b. SP11 - Power Tool Cleaning to Bare Metal

1.03 SUBMITTALS:

A. Submit as specified in DIVISION 1.

B. Includes, but not limited to, the following:

1. Fabrication drawings for all WORK
2. All necessary information for the fabrication, including filler metal for welds, of the component part of the structure, presented on drawings to conform to recognized standard practice, AISC Manual Part 5, and AWS Code

1.04 QUALITY ASSURANCE:

- A. Welder Qualifications:
1. Welders shall be previously qualified by passing the tests prescribed in the AWS Standard Qualification Procedure, or by passing such other tests as the DISTRICT may accept.
 2. Welders shall have been tested within the past twelve months and their qualification shall be considered as remaining in effect unless the welder is not engaged in a given process of welding for a period exceeding six months.
 3. Submit two certified copies of the qualification records to DISTRICT as evidence of qualification to the above-mentioned code.
- B. Inspection: Material or workmanship will be subject to inspection in the shop and field.

1.05 DELIVERY, STORAGE AND HANDLING: Handle and store all steel and appurtenances as specified in DIVISION 1.

1.06 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 BASIC MATERIALS:

- A. Steel: Conform to ASTM A36, as designated in the AISC Manual, Part 1, unless otherwise indicated or specified.
- B. Anchor Bolts:
1. Conform to ASTM A307 using A36 steel, unless otherwise indicated to be galvanized steel.
 2. Washers: Conform to F436.
- C. Welding:
1. For ASTM A36 steel, use E70 electrodes for shielded metal arc welding, F7 series electrodes for submerged arc and E70T series electrodes for flux cored arc welding.
 2. Galvanizing: Galvanize steel after fabrication to conform to ASTM A123 and ASTM A153, where indicated or specified. Nuts, bolts and washers may be hot-dip galvanized to conform to ASTM A153 or mechanically galvanized to conform to ASTM B695.

2.02 STEEL FABRICATION:

- A. Fabricate all steel to conform to AISC specifications, codes and standards.
- B. Permissible variations for sweep, camber, length and cross-section of all steel members shall conform to ASTM A6, AISC "Manual of Steel Construction, Part 1 "and AISC" Quality Criteria and Inspection Standards" unless indicated otherwise.
- C. Welding:
1. All welding shall be shielded metal arc, submerged arc or flux cored arc. Other welding processes may be used provided they are qualified by applicable tests as prescribed in the AWS D1.1 Code and approved by the DISTRICT prior to use.

For the use of any other welding process, the CONTRACTOR shall prepare and submit to the DISTRICT for approval, a qualified welding procedure specification and the procedure qualification test results. These submittals shall be deemed compliance submittals and these

other welding processes shall be approved for use only after receipt of specific written approval from the DISTRICT.

2. Conform to AWS Code, AISC Manual Part 4 and the AISC Quality Criteria and Inspection Standards.
 3. The CONTRACTOR shall perform fabrication-welding inspection in accordance with AWS D1.1. AWS Certified Welding Inspector(s) (CWI) shall perform this welding inspection. All such Certified Welding Inspectors shall be qualified and certified in accordance with the provisions of AWS QC1. Only individuals so qualified shall be authorized to perform fabrication/erection or verification inspection of the welding performed under the provisions of this AWS D1.1 Code and these Contract Documents. Certifications verifying the qualifications of welding inspectors shall be submitted to the DISTRICT as compliance submittals prior to commencement of structural welding operations and/or prior to welding inspection performed by an individual welding inspector. Defective welds shall be corrected.
- D. Shop Connections:
1. Weld, rivet, or bolt as indicated or specified.
 2. Shop portions of connections may be welded equivalent to any bolted connection specified if DISTRICT concurs.
 3. Welded connections shall be as indicated or in accordance with acceptable alternative designs.
 - a. All butt joint groove welds shall be complete penetration welds unless otherwise indicated and shall conform to the applicable standards in AISC Manual Part 4 with special emphasis on maintaining root opening. Accomplish this for single-bevel butt joint welds by using backup plates or by chipping out and welding on the opposite side.
 - b. Prepare weld bevels with a mechanically guided cutting torch or by grinding.
 - c. Remove all run-out tabs.

2.03 STEEL FLOOR GRATING:

- A. One-piece, resistance-welded carbon steel construction without notching of bearing or cross bars before welding
- B. Bearing Bars:
 1. Thickness: 3/16-inch
 2. Depth: 1 inch
 3. Spacing: 1-3/16 inches on centers
 4. Top Surface of Main Bars shall be serrated
- C. Cross Bars:
 1. Spacing: 4 inches on centers
- D. Fabrication:
 1. Main bars shall be vertical within a tolerance of 0.10 inch per inch of depth.
 2. Longitude bow (before fastening to supports) shall be less than 1/200 of the length.
 3. Transverse bow before fastening to supports shall be less than 3/8-inch in three (3) feet.
 4. Crossbars shall not deviate from a straight line perpendicular to the main bars by more than 3/16-inch in three (3) feet.
 5. Crossbars shall match crossbars of adjacent sections to form a continuous pattern of straight lines.

6. Panel width and length tolerances shall be +/- 1/4 inch.
 7. Provide all openings in grating indicated under this Contract.
 8. Band all openings with a metal bar same size as main bearing bar and extend four (4) inches above top of grating. Weld to each bearing bar with a 3/16-inch fillet weld 3/4-inch long. Tack weld to all crossbars.
 9. Trim-band all locations as follows:
 - a. Hinged sections
 - b. Grating panels with four crossbars or less
 - c. Other locations as indicated
- E. Shop Finish: Galvanized
- F. MANUFACTURER: Grating shall be manufactured by one of the following:
1. Blaw-Knox, Pittsburgh, Pennsylvania
 2. Tru-Weld Grating, Inc., Pittsburgh, Pennsylvania
 3. IKG Industries
 4. Klemp Corporation, Chicago, Illinois
 5. Borden Metal Products Company, Elizabeth, New Jersey
 6. Approved equal

PART 3 - EXECUTION

3.01 STEEL ERECTION:

- A. Erect all steel to conform to AISC specifications, codes and standards, AISC Quality Criteria and Inspection Standard or any local, State or Federal Codes which may exceed such requirements.
- B. Grating:
 1. Space fasteners as required to overcome irregularities and maintain grating contact with supports. Minimum anchorage of each panel will be one fastener at 12" O.C. at ends and one fastener at 12" O.C. at each intermediate support.
 2. Unless indicated as fixed, or if galvanized, fasten with galvanized clips using welding studs. Welded studs shall conform to Nelson Stud Welding Company Type CPL, or approved equal. Install per MANUFACTURER's printed instruction.
 3. All grating shall be removable unless otherwise indicated.

3.02 FIELD PROTECTIVE COATINGS:

- A. Surface Preparation: If grease or oils are present, SP1 - Solvent Cleaning must precede any other method specified. Prepare all surfaces by SSPC-SP11 and one (1) mil profile depth.
 1. Clean all shop coated surfaces damaged from rust and mill scale, welding and abrasion.
- B. Field spotting coat:
 1. Apply to cover all unpainted or blemished parts of the steel furnished under this Contract including unpainted portions of field welded and bolted connections.
 2. For galvanized surfaces, apply epoxy organic zinc-rich primer at 3 mils dry. Primer may be any of the following at CONTRACTOR's option.

- a. Ameron - 68
- b. Carboline - SP676
- c. Cook - Galva Pac 135
- d. Glidden - 5526/5527/5528
- e. Koppers - Organic Zinc
- f. Porter - Zinc-Lock 308
- g. ZRC Products Co. - Cold Galvanizing Compound

END OF SECTION

SECTION 05510 STEEL STAIRS, LADDERS AND PLATFORMS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The Work of this Section shall consist of furnishing all labor, material, and equipment necessary for the installation of steel stairs, ladders, and platforms as shown on the drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 05100 Structural Steel
 - 2. SECTION 05521 Handrails, Railings, and Guardposts
 - 3. SECTION 05550 Fabricated Metalwork and Castings
 - 4. SECTION 05600 Miscellaneous Metals
 - 5. SECTION 09900 Protective Coatings

1.02 APPLICABLE PUBLICATIONS:

- A. American Institute of Steel Construction (AISC):
 - 1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings
- B. American Welding Society (AWS):
 - 1. D1.1: Structural Welding Code - Steel
- C. Aluminum Association Standard Anodic Finishes (AASAF)
- D. American Society for Testing and Materials (ASTM) Publications:
 - 1. A6/A6M: Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
 - 2. A36/A36M: Specification for Carbon Structural Steel
 - 3. A123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 4. A143: Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement
 - 5. A153/A 153M: Specification for Zinc Coating (Hot-Dip) on Iron and Steel hardware
 - 6. A269: Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
 - 7. A325: Specification for High Strength bolts for Structural Steel Joints
 - 8. A384: Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
 - 9. A385: Practice for Providing High Quality Zinc Coatings (Hot-Dip)
 - 10. F436: Specification for Hardened Steel Washers
 - 11. A563: Specification for Carbon and Alloy Steel Nuts
 - 12. A780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

1.03 QUALITY ASSURANCE:

- A. Obtain field measurements prior to preparation of shop drawings and fabrication.
 - B. Welding Qualification and Certification:
 - 1. Furnish written welding procedure for all welds in conformance with AWS Structural Welding Code.
 - 2. Each welder, tacker and welding operator shall be certified by test within the past six months to perform type of work required in conformance with AWS Structural Welding Code. Testing shall be conducted, and witnessed by an independent testing laboratory.
 - 3. Maintain duplicate qualification and certification records at the job site readily available for examination.
 - C. Galvanize:
 - 1. Reject all galvanized material, including bolt assemblies, not conforming to specifications.
 - 2. Reject all galvanized material arriving at the site damaged or damaged during construction.
- 1.04 **SUBMITTALS**: Submit shop drawings, signed and sealed by a Professional Engineer registered and active in the state of Florida, for all steel stairs, ladders and platforms showing materials, configurations, dimensions, accessories, anchorage, etc.
- 1.05 **WARRANTY**:
- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion.
 - B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA:

- A. Stairs and ladders shall be designed to withstand a minimum uniform live load of 100 psf or a concentrated live load of 300 pounds applied on an area of 4 square inches at any point along the element.
- B. Platforms shall be designed to withstand the live loads indicated. If the design live load does not appear on the drawings, platforms shall be designed for a minimum uniform live load of 100 psf or a concentrated live load of 300 pounds applied on an area of 4 square inches at any point along the element.
- C. Ladders shall be designed to withstand a minimum of two loads of 250 pounds each, concentrated between any two consecutive attachments. The number and spacing of additional loads shall be in accordance with the anticipated usage of the ladder. Individual steps or rungs shall be designed to support a load of 250 pounds applied at any point.

2.02 **MATERIALS**: Comply with the requirements of the indicated specification.

- A. Steel plates, shapes, pipe and castings shall conform to the following ASTM specifications:
 - 1. Structural steel shapes, bars and plates: ASTM A36
 - 2. Steel Pipe: ASTM A53
 - 3. Cold-rolled or hot-rolled carbon steel sheets: ASTM A366 or ASTM A569

4. Structural tubing: ASTM A500 or ASTM A501
 5. Castings: ASTM A47 (Grade 32510) or ASTM A48 (Class 30)
 6. Nuts, bolts and washers: ASTM A325
- B. Welding:
1. Provide filler materials that appropriate for the alloys and tempers in accordance with the AWS Structural Welding Code.
 2. Provide Class E70XX electrodes.

2.03 FABRICATION:

- A. General:
1. Fabricate true to shape, size and tolerances as indicated and specified.
 2. Straighten work bent by shearing or punching.
 3. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded.
 4. Provide sufficient quantity and size of anchors for the proper fastening of the work.
 5. Fabricate details and connection assemblies in accordance with drawings, with projecting corners clipped and filler pieces welded flush.
 6. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.
 7. Use connections of type and design required by forces to be resisted, and to provide secure fastening.
 8. Fit work together in fabrication shop and deliver complete, or in parts, ready to be set in place.
- B. Welding:
1. Grind exposed edges of welds to a 1/8 inch minimum radius. Grind burrs, jagged edges and surface defects smooth.
 2. Prepare welds and adjacent areas such that there is no undercutting or reverse ridges on the weld bead and no sharp peaks or ridges along the weld bead.
 3. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
- C. Bolting:
1. Provide galvanized stud bolts, nuts and washers for fastening galvanized steel material.
 2. Provide holes required for the connection of adjacent or adjoining work wherever noted on drawings. Locate holes for bolting to supports to a tolerance of + 1/16 inch of exact dimensions indicated.
- D. Riveted Grating Treads:
1. Provide stair treads of the same type and bar spacing as grating specified.
 2. Raise serrated top surface of connecting bars slightly above the top surface of the bearing bars.
 3. Provide 2 1/2" x 3/16" carrier end plates welded to stair treads and punched for bolting to stringers.
 4. Provide 1-1/4 inch abrasive nosings.
 5. Manufacturers:

- a. Type K as manufactured by IKG Borden Metal Products Co.
- b. Type W Series as manufactured by Ohio Gratings, Inc.
- c. Type B as manufactured by McNichols Co.
- d. District approved equal

2.04 STEEL PLATFORMS:

- A. Provide galvanized steel platforms fabricated from structural steel shapes, grating, plates, pipes and tubes as indicated.
- B. Provide galvanized steel riveted grating as specified in Section 05600.
- C. Railings and Handrails: Provide galvanized steel pipe railing as specified in Section 05521.

2.05 HOT-DIP GALVANIZING:

- A. Provide hot-dip galvanizing in conformance with ASTM A123, Grade 100 to all grating and frames.
- B. Provide hot-dip galvanizing, in conformance with ASTM A153, to all bolts, nuts and washers that will be used with galvanized steel.
- C. Complete all fabrication and prepare surfaces of steel by removing all weld spatter, flux, residue, burrs and metal surface defects before galvanizing. Clean weldments with power wire brush prior to galvanizing.
- D. Provide steel dipped into solution of zinc chloride plus ammonium chloride immediately prior to galvanizing. Do not use galvanizing process utilizing flux blanket overlaying molten zinc.
- E. Chromate treat all pieces that will be in contact with or encased in concrete or masonry after galvanizing. One coat of one of the following coal tar epoxy coating systems may be substituted for the chromate treatment:
 1. 46H-413 Hi-Build Tneme Tar by Tnemec Co. Inc.
 2. Bitumastic 300M by Carboline Co.
 3. Targuard by Sherwin Williams Co.
 4. District approved equal
- F. Tap bolt nuts after hot-dip galvanizing in conformance with ASTM A563.
- G. Inspect galvanized material for compliance with these specifications. Mark the material with a clearly visible stamp indicating the name of the galvanizer, the ASTM number and the weight of zinc coating in ounces per square foot.

2.06 GALVANIZE TOUCH-UP:

- A. Repair damaged galvanized coating using paints containing zinc dust in conformance with ASTM A780.
- B. Field touch-up all damaged galvanized surfaces after installation with one of the following zinc rich coatings:
 1. Endupor, zinc-rich coating by Dampney Manufacturing Co.
 2. ZiRP, zinc-rich coating by Duncan Galvanizing Corp.
 3. ZRC Cold Galvanizing Compound by ZRC Chemical Products Co., Division of Norfolk Corp.
 4. District approved equal

PART 3 - EXECUTION

3.01 GENERAL:

- A. Set and secure in place as indicated. Where bolted connections are used, draw together and draw nuts tightly. Use bolts of lengths required so that they do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.
- B. Locate anchors and anchor bolts and build into connecting work. Insert expansion bolts into drilled holes.
- C. Install stairs and ladders in accordance with approved shop drawings.

3.02 STEEL STAIRS:

- A. Provide galvanized structural steel angles, struts, rod hangers, closure plates, and brackets indicated.

3.03 GALVANIZE TOUCH-UP:

- A. Touch-up abraded hot-dip galvanized areas by the brush applied method with zinc-rich coatings as specified herein having dry film thickness of not less than 6 mils. Make all repairs to galvanized surfaces in conformance with ASTM A780.

END OF SECTION

SECTION 05521 HANDRAILS, RAILINGS, AND BOLLARDS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK of this SECTION shall consist of furnishing all labor, material, and equipment necessary for the installation of handrails, railings, and bollards as shown on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 03600 – Grout
 - 2. SECTION 05070 – Bolted Fasteners
 - 3. SECTION 05100 - Structural Steel

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society for Testing and Materials (ASTM)
 - a. A36 – Standard Specification for Carbon Structural Steel
 - b. A47 - Standard Specification for Ferritic Malleable Iron Castings
 - c. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - d. A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
 - e. A116 - Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
 - f. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
 - g. A385 - Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
 - h. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - i. A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
 - 2. American Welding Society (AWS)
 - a. D1.1 – Structural Welding Code – Steel
 - b. D11.2 – Guide for Welding Iron Casting
 - 3. Florida Fire Prevention Code

1.03 SUBMITTALS:

- A. Submit Shop Drawings, signed and sealed by a Professional Engineer registered and active in the State of Florida, for all handrails and railings showing materials, configurations, dimensions, accessories, anchorage, etc.

1.04 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER's standard warranty, but for no less than one (1) year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS: Comply with the requirements of the indicated specification.

- A. Steel Plates and Bars (except plates to be cold-formed): American Society for Testing and Materials ASTM A36
- B. Cold-Formed Steel Plates: ASTM A283, Grade C
- C. Steel Tubing:
 - 1. ASTM A500, cold-formed, welded or seamless
 - 2. ASTM A501, hot-formed, welded or seamless
- D. Cold-Finished Steel Bars: ASTM A108, grade as selected by fabricator
- E. Steel Pipe: ASTM A53, Grade B; black finish unless galvanizing is indicated; standard weight (Schedule 40) unless otherwise shown or specified
- F. Steel Finish: Shop prime paint, except where galvanized finish indicated
- G. Malleable Iron Castings: ASTM A47, grade as required
- H. Non-shrink, Nonferrous Grout: SECTION 03600
- I. Bollards: ASTM 53 Grade B, galvanized steel pipe filled with concrete

2.02 FABRICATION:

- A. General:
 - 1. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise shown.
 - 2. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the WORK.
 - 3. Hot-dip galvanize all steel railings, including pipe, fittings and other ferrous metal components after fabrication, unless otherwise indicated on the Drawings. Fabricated railing units to be galvanized shall have vent and drain holes in accordance with ASTM A385.
- B. Non-welded Connections: When acceptable to the DISTRICT, intermediate post-to-rail connections may be made using internal pipe sleeve locks and Allen screw fasteners. Locking devices that do not produce flush, smooth, rigid, hairline joints will not be acceptable. Weld other connections.
- C. Welded Connections: Cope intersections of rails and posts, weld joints and grind smooth. Butt weld end-to-end joints of railings or use welding connectors, at fabricator's option.
 - 1. At connections to steel supports, weld post directly to steel supports, unless otherwise indicated.
 - 2. Other methods of welding may be used when acceptable to the DISTRICT.

3. Weld corners and seams continuously and in accordance with the recommendations of American Welding Society (AWS). Grind exposed welds smooth and flush, to match and blend with adjoining surfaces. Discoloration of finished surfaces will not be acceptable.
 4. Form exposed connections with flush, smooth, hairline joints, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, use Phillips Flathead (countersunk) screws or bolts.
 5. Provide for anchorage of the type shown, coordinated with the supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support.
- D. Brackets, Flanges, and Anchors:
1. Furnish cast metal brackets, flanges, and exposed anchors of the same material and finish as supported rails, unless otherwise indicated.
 2. Furnish all fastenings as required for anchorage of railings to concrete or masonry work.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railing items to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts and other connectors as required. Use railing manufacturer's standard method of installation when acceptable to the DISTRICT.
- B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Fit exposed connections accurately together to form tight hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop-welded because of shipping size limitations. Grind joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of units that have been coated or finished after fabrication, and are intended for field connections. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than four (4) feet on centers, unless otherwise shown on the Drawings. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
1. Anchor posts in concrete by means of pipe sleeves set and anchored into the concrete. Provide sleeves of galvanized, steel pipe, not less than six (6) inches long and having an inside diameter not less than 1/2 inch greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve and of width and length not less than one (1) inch greater than the outside diameter of the sleeve. After the posts have been inserted into the sleeves, fill the annular space between post and sleeve solid with nonshrink, nonferrous grout. Cover anchorage joint with a round metal flange to match post.
- C. Secure handrails to walls with wall brackets and end fittings. Provide brackets with not less than 1-1/2 inches clearance from inside face to handrail to the finish wall surface. Drill wall plate portion of the bracket to receive one bolt, unless otherwise indicated for concealed anchorage. Locate brackets as indicated or, if not indicated, at not more than eight (8) feet on center. Provide flush-type wall return fittings with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:
1. For concrete and solid masonry anchorage, use stainless steel epoxy-set anchors. .
 2. For hollow masonry anchorage, use Hilti HIT-HY 20 for Masonry Anchoring System, manufactured by Hilti Corporation, Tulsa, OK.
 3. For drywall anchorage, provide horizontal wood blocking connecting consecutive studs, use toggle bolts having square heads.

D. Bollards:

1. Refer to the Drawings for pipe diameters.
2. Erect bollards plumb and aligned and located as shown on civil drawings, footings as shown on the Drawings. Fill steel pipes with 3,500 pounds per square inch (psi) concrete and finish top smooth and convex. Paint and finish as required by the DISTRICT. Unless otherwise indicated, paint as specified for structural work in SECTION 05100.

END OF SECTION

SECTION 05550 FABRICATED METALWORK AND CASTINGS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work:
 - 1. The WORK of this SECTION shall consist of furnishing all labor, materials, and equipment necessary for the installation of fabricated metalwork and castings as shown on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. DIVISION 1 – General Requirements
 - 3. SECTION 05070 – Bolted Fasteners
 - 4. SECTION 05100 - Structural Steel
 - 5. SECTION 09900 – Protective Coating

1.02 GENERAL:

- A. Like items of material provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B. See Conditions of the Contract and DIVISION 1, General Requirements, which contain information and requirements that apply to the WORK specified herein and are mandatory for this Project.
- C. Provide the material types where specified on the Drawings.

1.03 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Aluminum Association – Construction Manual Series
 - 2. American National Standard Institute (ANSI)
 - a. B1.1 Unified Inch Screw Threads, UN and UNR Thread Form
 - 3. American Society for Testing and Materials (ASTM)
 - a. A36 – Standard Specification for Carbon Structural Steel
 - b. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - c. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - d. A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - e. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - f. A276 - Standard Specification for Stainless Steel Bars and Shapes

- g. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- h. A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing
- i. A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- j. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- k. A992 – Standard Specification for Structural Steel Shapes
- l. A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- m. B210 - Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
- n. B211 - Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire
- o. B241/B241M - Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
- p. B308 – Standard Specification for Aluminum Alloy 6061 T6 Standard Structural Profile
- q. B429/B429M - Specification for Aluminum-Alloy Extruded Structural Pipe and Tub
- 4. American Institute of Steel Construction (AISC)
 - a. Steel Construction Manual
- 5. American Welding Society (AWS)
 - a. D1.1 - Structural Welding Code - Steel
 - b. D1.2 – Structural Welding Code – Aluminum
 - c. D1.6 Structural Welding Code – Stainless Steel
- 6. Florida Building Code
- 7. International Code Council (ICC)
- 8. National Association of Architectural Metal Manufacturers (NAAMM)

1.04 **SUBMITTALS**: Submittals shall be made in accordance with SECTION 01300, and General Terms & Conditions. In addition, the following specific information shall be provided:

- A. Shop Drawings, including calculations where required
- B. Test pieces and samples
- C. Certificates, test reports, etc.

1.05 **WARRANTY**:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER's standard warranty, but for no less than one (1) year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. The use of MANUFACTURER’s name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other MANUFACTURERS will be considered in accordance with the General Terms & Conditions.
- B. Unless otherwise indicated, all materials shall conform to the latest issue of the following ASTM Specifications:

| <u>Item</u> | <u>ASTM Specification</u> |
|--|--|
| Carbon Steel: | |
| Structural Shapes, Sections | |
| M-Shapes | A36 |
| W-Shapes | A992 |
| S-Shapes | A36 |
| HP-Shapes | A572, Grade 50 |
| C-Channels | A36 |
| MC-Channels | A36 |
| L-Angles | A36 |
| Round Hollow Structural Sections | A500, Grade B |
| Rectangular Hollow Structural Sections (HSS) | A500, Grade B |
| Pipes | A53, Grade B |
| Plates, Bars | A36 |
| Stainless Steel | |
| Bars & Shapes | A276, Type 304/304L |
| Hollow Structural Sections | A554, Type 304/304L |
| Steel Plate, Sheet & Strip | A167, Type 304/304L |
| Aluminum, Structural Shapes & Plates | Alloy 6061-T6; conform to referenced specifications and ASTM Sections found in the Aluminum Association current Construction Manual Series |
| Connection Bolts for Aluminum | Use appropriate Stainless Steel |

- C. The miscellaneous metalwork and castings indicated on the Drawings, or required to secure the various parts together and provide a complete installation, shall be included under this SECTION.

2.02 STRUCTURAL STEEL SUPPORTS:

- A. Provide all structural steel supports of the sizes and weights shown. All connections shall be welded, unless otherwise shown on the Drawings.

2.03 GRATING:

- A. All grating utilized on Project shall be of galvanized, welded steel bar grating, unless specifically indicated otherwise.
- B. Gratings shall be provided with all frames, seat angles, fasteners, and other appropriate accessories as required. Metals to be embedded in concrete shall be Type 304/304L stainless steel, unless indicated otherwise on the Drawings.
- C. Fasteners for anchoring grating to beam and channel flanges shall be Universal clip type with 1/4 inch bolts and nuts. Furnish a minimum of four (4) fasteners for each panel, or as required, for proper support to each panel, unless otherwise noted on the Drawings.
- D. Standard installation clearances and tolerances shall conform to the requirements of the current Metal Bar Grating Manual published by the National Association of Architectural Metal Manufacturers.
- E. Width of any single grating section shall not exceed four (4) feet, unless specified otherwise on the Drawings.
- F. Grating shall be of the minimum thickness indicated on the Drawings for the various spans and shall be designed using a uniform live load of 100 pounds per square foot, unless otherwise noted on the Drawings.
- G. Provide angle supports as indicated. Size support angles to provide a minimum of one (1) inch support for all main-bearing bars.
- H. Main bearing bars shall be serrated, of 3/16 inch thickness unless otherwise specified on the Drawings and 1-3/16 inch center-to-center, with depth designated as grating thickness on the Drawings. Provide welded 3/16 inch banding for all openings and grating ends. Cross bar spacing shall be a maximum of four (4) inches center-to-center, unless otherwise specified on the Drawings.
- I. Grating shall have exposed surfaces zinc-coated by the hot dip process, after fabrication, in accordance with ASTM A123. Coating thickness shall be not less than 1.8 ounces per square foot of exposed surface.
- J. Steel used in bearing bars, cross bars and connecting bars of rectangular section shall conform to ASTM A1011 Commercial Steel, Type B, for hot rolled carbon steel sheet and strip.

2.04 SHOP FABRICATED ITEMS:

- A. Corner Guards and Other Shapes Indicated as Cast-In-Concrete:
 - 1. Metals to be embedded in concrete shall be Type 304/304L stainless steel, unless indicated otherwise on the Drawings. Weld round rod anchors as detailed or required. At corners, miter, weld and grind smooth. Follow basic material requirements.
- B. Fabricated Metalwork:
 - 1. Fabricate true to shape, size and tolerances as indicated and specified on the Drawings.
 - 2. Dress expose edges and ends of metal smooth, with no sharp edges and with corners slightly rounded.
 - 3. Provide sufficient quantity and size of anchors for the proper fastening of the WORK.
 - 4. Fabricate details and connection assemblies in accordance with the Drawings, with projecting corners clipped and filler pieces welded flush.

5. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.
6. Use connections of type and design required by forces to be resisted, and to provide secure fastening.
7. Fit work together in fabrication shop and deliver complete, on in parts, ready to be set in place.
8. Provide holes required for the connection of adjacent or adjoining work wherever noted on the Drawings. Locate holes for bolting to supports to a tolerance of +1/16 inch of exact dimensions indicated on the Drawings.

2.05 LIFTING LUGS:

- A. Individual equipment and/or each field disassembling part over 100 pounds in weight shall be provided with proper lifting lugs for easy handling.

2.06 SQUARE MESH WIRE CLOTH:

- A. Wire fabric shall be Type 304 stainless steel. Size shall be 1/2 inch expanded mesh with 16-gauge wire and 70 percent open area. Bond edges of wire cloth with rolled Type 304 stainless steel, 24-gauge band.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Workmanship and finish of all metalwork specified under this SECTION shall be of the highest grade and equal to the best practice of modern shops for the respective WORK. Exposed surfaces shall have smooth finish and sharp, well-defined lines. Provide all necessary rabbets, lugs, and brackets so that the WORK can be assembled in a neat, substantial manner. Conceal fastenings where practical. Drill metalwork and countersink holes as required for attaching hardware or other materials. Fabricate metals as specified. Weld connections, except where bolting is directed. Items requiring special fabrication methods are mentioned herein. Fabrication of all other items shall be of equal quality. Methods of fabrication not otherwise specified or shown shall be adequate for the stresses and as approved by the DISTRICT.
- B. Grind all exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases, and where indicated on the Drawings. All sharp edges shall be rounded to a 1/8 inch minimum radius; all burrs, jagged edges, and surface defects shall be ground smooth.
- C. Welds and adjacent areas shall be prepared such that there is (1) no undercutting or reverse ridges on the weld bead, (2) no weld spatter on or adjacent to the weld or any other area to be painted, and (3) no sharp peaks or ridges along the weld bead. All embedded pieces of electrode or wire shall be ground flush with the adjacent surface of the weld bead.

3.02 WELDING:

- A. The technique of welding employed, appearance, quality of welds made, and the methods of correcting defective WORK shall conform to codes for Arc and Gas Welding in Building Construction of the AWS and AISC. Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign materials, except that mill scale that will withstand vigorous brushing may remain. A light film of linseed oil may likewise be disregarded. No welding shall be done when the temperature of the base metal is lower than 0 degrees Fahrenheit. Finished members shall be true to line and free from twists.
- B. All welding operators shall be qualified in accordance with the requirements of current AWS Standard Qualification Procedure D1.1, Chapter 5, and welders of structural and reinforcing steel shall be

certified for all positions of welding in accordance with such procedure. A recognized testing laboratory shall run qualification tests at the CONTRACTOR's expense.

- C. All welding operators shall be subject to examination for requalification using the equipment, materials, and electrodes employed in the execution of the Contract WORK. Such requalification, if ordered by the DISTRICT, shall be done at the expense of the CONTRACTOR.

3.03 INSTALLATION OF FABRICATED METALWORK:

- A. Install in accordance with the Shop Drawings, the Drawings, and these specifications. Perform field welding and erection WORK by skilled mechanics. Install fabricated metalwork plumb or level as applicable. The complete installations shall, in all cases, be rigid, substantial, and neat in appearance. Erect structural steel in accordance with the applicable portions of AISC Code of Standard Practice, except as modified. Install commercially manufactured products in accordance with MANUFACTURER's recommendations as approved.

- 1. Aluminum: Erection of aluminum shall be in accordance with the Aluminum Association. Mill marking shall not be removed from concealed surfaces. Exposed surfaces not otherwise coated shall have the inked or painted identification marks removed after the material has been inspected and approved by the DISTRICT.

3.04 GALVANIZING AND REPAIR:

- A. Galvanizing of steel plates, shapes, bars (and products fabricated from these items), and strip 1/8-inch thick or thicker, shall conform to ASTM A123. Material thinner than 1/8 inch shall either be galvanized before fabrication in conformance with the requirements of ASTM A653, Coating Designation G210 or after fabrication, in conformance with the requirements of ASTM A123, except that the weight of zinc coating shall average not less than 1.2 ounces per square foot of actual surface area with no individual specimen having a weight of less than 1.0 ounce. Unless otherwise provided, galvanizing shall be done before or after fabrication, for material that is thinner than 1/8 inch, at the option of the CONTRACTOR. Galvanizing will not be required for stainless steel, monel metal, and similar corrosion-resistant parts.

- B. All welded areas shall be thoroughly cleaned prior to galvanizing to remove all slag or other material that would interfere with the adherence of the zinc. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the zinc coating.

- C. In like manner, galvanizing of iron and steel hardware, and nuts and bolts, shall conform to ASTM A153. Galvanizing shall be performed after fabrication. Galvanizing of tapped holes will not be required.

- D. Fabrication shall include all operations such as shearing, cutting, punching, forming, drilling, milling, bending, welding, and riveting.

- E. Components of bolted assemblies shall be galvanized separately before assembly.

- F. The minimum pitch diameter of the threaded portion of all bolts, anchor bars, or studs shall conform to ANSI B1.1, having a Class 2A tolerance before galvanizing. After galvanizing, the pitch diameter of the nuts or other threaded parts may be tapped over ANSI B1.1, Class 2B tolerance, by the following maximum amounts:

| | |
|----------------------------|---------------------|
| 3/8 inch through 9/16 inch | 0.016 inch oversize |
| 5/8 inch through 1 inch | 0.023 inch oversize |
| 1-1/8 inches and larger | 0.033 inch oversize |

- G. Except for inlet grates not otherwise required to be welded, all edges of tightly contacting surfaces, where galvanizing is required, shall be completely sealed by welding before galvanizing.

- H. Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired in accordance with SECTION 09900.

3.05 ELECTROLYTIC PROTECTION:

- A. Where aluminum is in contact with dissimilar metals, or to be embedded in masonry and concrete, protect surfaces in accordance with SECTION 09900 (A-1). Allow paint to dry before installation of the materials. Protect painted surfaces during installation; should coating become marred, prepare and touch up surface per paint MANUFACTURER's instructions.

3.06 PAINTING:

- A. Thoroughly clean all ferrous metal items not galvanized and give a shop coating of metal primer. Preparation of surfaces and application of primer shall be in accordance with the paint MANUFACTURER's printed directions and recommendations as approved; and in accordance with SECTION 09900, utilizing the appropriate painting system.

3.07 PREPARATION FOR SHIPMENT:

- A. Items provided in this SECTION shall be factory assembled to the greatest extent possible. The parts and assemblies that are of necessity shipped unassembled, shall be packaged and clearly tagged in a manner that will protect the materials from damage, and facilitate the identification and final assembly in the field.

END OF SECTION

SECTION 05600 MISCELLANEOUS METALS

PART 1 - GENERAL

- 1.01 MATERIALS: Materials shall be new, free from defects impairing strength, durability of appearance, and of best commercial quality for intended purposes.
- 1.02 SUBMITTALS: Submit for acceptance fully detailed shop and erection drawings for all miscellaneous metal work required for this project. Include with submittal color selections as required.
- 1.03 RELATED WORK SPECIFIED ELSEWHERE:
- A. SECTION 05100 Structural Steel
 - B. SECTION 13120 Precast Concrete Building
 - C. SECTION 05500 Fabricated Metalwork and Castings
- 1.04 WARRANTY:
- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
 - B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

- 2.01 BASIC MATERIALS:
- A. Miscellaneous Structural Shapes: ASTM A36
 - B. Miscellaneous Aluminum Shapes: ASTM B221, alloy 6063 T-5, Sheet: ASTM B 209, alloy 3003, tempered as required
 - C. Miscellaneous Iron Castings: ASTM A48, Class 30
 - D. Anchors and Fastenings: Compatible with material to be fastened
 - E. Shop Primer: No. 5210 Universal Primer by Glidden
 - F. Isolator for Aluminum and Specified Galvanized Metals: Aluminum pigmented bituminous paint or epoxy
- 2.02 FINISHES:
- A. Hot-dipped galvanizing ASTM A386, Class C, for angle thresholds and all other shapes cast-in or directly attached to concrete or masonry.
 - B. Shop Primer: One coat on all ferrous metals not scheduled or required to be galvanized.
 - C. Caustic Etch and Lacquer: Miscellaneous aluminum.
- 2.03 SHOP FABRICATED ITEMS:
- A. Metal Stairs: To detail conforming to all codes and regulations governing industrial stairs.

- B. Pipe Railings: 1-1/2-inch diameter schedule 40, all welded construction, galvanized after fabrication.
- C. Angle Thresholds, Corner Guards, and Other Shapes Indicated as Cast-In-Construction: Weld round-rod back anchors as detailed or required. At corners, miter, weld and grind smooth. Follow basic material requirements.
- D. Steel Pipe Stanchions: 4" diameter schedule 40 galvanized steel pipe, heights as shown on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Follow accepted shop and erection drawings. Coordinate with work of Section 03100 for items cast into concrete.
- B. Isolate aluminum surfaces in contact with other surfaces with two (2) coats of specified paint.
- C. Isolate galvanized surfaces to be cast into concrete with two (2) coats of specified paint.

3.02 FIELD WELDING: Conform to AWS Code Standards. Use certified welders.

3.03 MISCELLANEOUS:

- A. Furnish all fastenings including lag screws, rods, bolts, washers, nuts, and inserts as required to complete all work.
- B. Embed pipe stanchions minimum 3 inches below grade in minimum 1-foot-4-inches diameter by 3-foot-6-inches deep 3000 psi concrete.

END OF SECTION

SECTION 07900 SEALANTS

PART 1 - GENERAL

1.01 SCOPE: The required applications include, but are not necessarily limited to, the following:

- A. Flashing and Joints
- B. Partition and Ceiling Joints
- C. Equipment and Isolation Joints
- D. Gasketing for Assembly of Components

1.02 SUBMITTALS:

- A. **Manufacturer's Data, Joint Sealers:** Submit manufacturer's specifications, recommendations and installation instructions for each type of material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.
- B. **Guarantee, Joint Sealers:** Submit written guarantee agreeing to repair or replace joint sealers which fail to perform as airtight and watertight joints, or fail in joint adhesion, cohesion, abrasion resistance, stain resistance, or general durability, or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. Provide guarantee signed by the CONTRACTOR. Guarantee period shall be two (2) years.

1.03 JOB CONDITIONS:

- A. The CONTRACTOR must examine the joint surfaces and backing, and their anchorage to the structure, and the conditions under which the joint sealer work is to be performed. Do not proceed with the joint sealer work until unsatisfactory conditions have been corrected.
- B. Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range.

1.04 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. **Colors:** For exposed materials provide color as indicated or, if not indicated, as selected by the DISTRICT from manufacturer's standard colors. For concealed materials, provide the natural color that has the best overall performance characteristics.

- B. Hardness: As recommended by manufacturer for application shown, unless otherwise indicated.
- C. Modulus of Elasticity: Provide the lowest available modulus of elasticity which is consistent with exposure to weathering, indentation, vandalism, abrasion, support of loading, and other requirements.
- D. Compatibility: Before purchase of each required material, confirm its compatibility with each other material it will be exposed to in the joint system.
- E. Size and Shape: As shown or, if not shown, as recommended by the manufacturer for the type and condition of joint, and for the indicated joint performance or movement.
- F. Grade of Sealant: For each application, provide the grade of sealant (non-sag, self-leveling, no-track, knife grade, preformed) as recommended by the manufacturer for the particular condition of installation (location, joint shape, ambient temperature, and similar conditions) to achieve the best possible overall performance. Grades specified herein are for normal condition of installation.
- G. One-Component Polysulfide Sealant: Polysulfide based, one-part elastomeric sealant, complying with FS TT-S-00230, Class A, Type II (non-sag), unless Type I recommended by manufacturer for the application shown.
- H. Two-Component Polysulfide Sealant: Polysulfide based, two-part elastomeric sealant.

2.02 NON-ELASTOMERIC SEALANTS:

- A. One-Component Acrylic Sealant: Acrylic terpolymer, solvent-based, one-part, thermoplastic sealant compound; solids not less than 95 percent acrylic; complying with FS TT-S-00230, Class B, Type II, recommended by manufacturer for general use as an exposed building construction sealant.
- B. Acrylic-Latex Sealant: Latex-rubber-modified, acrylic-emulsion-polymer sealant compound permanently flexible, non-staining, and non-bleeding, recommended by manufacturer for protected exterior exposure.

2.03 CAULKING COMPOUNDS: Synthetic Resin Caulking Compounds - Oil-based caulking compound complying with FS TT-C-598, except compounded only with special synthetic resins, non-staining, non-bleeding, paintable.

2.04 JOINT FILLERS: Provide type as recommended by manufacturer for use with joint type and sealant, non-staining, resilient.

2.05 MISCELLANEOUS MATERIALS:

- A. Oakum Joint Filler: Provide untreated hemp or jute fiber rope, free of oil, tar, and other compounds which might stain surfaces, contaminate joint walls, or not be compatible with sealants.
- B. Joint Primer/Sealer: Provide the type of joint primer/sealer recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.
- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by the sealant manufacturer to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.
- D. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam, or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer.

PART 3 - EXECUTION

- 3.01 **MANUFACTURER'S INSTRUCTIONS:** Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.
- 3.02 **JOINT PREPARATION:** Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances that would interfere with bond of sealant or caulking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous or glazed joint surfaces as recommended by sealant manufacturer. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- 3.03 **INSTALLATION:**
- A. Set joint filler units at proper depth or position in the joint to coordinate with other work, including the installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between the ends of joint filler units.
 - B. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.
 - C. Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
 - D. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.
 - E. Install sealant to depths shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - 1. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.
 - 2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
 - 3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75 percent to 125 percent of joint width.
 - F. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- 3.04 **CURE AND PROTECTION:** Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability. Protect joint sealers during the construction period so that they will be without deterioration or damage at the time of the DISTRICT's acceptance.

END OF SECTION

SECTION 07920 SEALANTS AND CAULKINGS

PART 1 - GENERAL

- 1.01 SCOPE: The CONTRACTOR shall furnish all labor, materials and equipment necessary for sealing and caulking as specified herein.
- 1.02 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- A. American Society for Testing and Materials (ASTM) Publications: C920-79 Elastomeric Joint Sealants.
- 1.03 SUBMITTALS:
- A. Certifications of Conformance of Compliance: Submit certificates from the manufacturers attesting that materials meet the specified requirements.
- B. Manufacturer's Descriptive Data: Submit complete descriptive data for each type of material. Clearly mark data to indicate the type the CONTRACTOR intends to provide. Data shall state conformance to specified requirements. Data for sealant and caulking shall include application instructions, shelf life, mixing instructions for multi-component sealants, and recommended cleaning solvents.
- C. Colors: Submit one (1) sample of each color for each sealant and caulking type to verify that products match the colors indicated. Where colors are not indicated, submit not less than four (4) different samples of manufacturers' standard colors for selection by the DISTRICT.
- 1.04 SAMPLE JOINTS: Before sealant and caulking work is started, provide a sample of each type of finished joint where directed on the project. The sample shall show the workmanship, bond, and color of sealant or caulking. The workmanship, bond, and color of sealant or caulking work throughout the project shall match the approved sample joints.
- 1.05 ENVIRONMENTAL CONDITIONS: The ambient temperature shall be within the limits of 40 and 100 degrees F. when the sealant and caulking are applied.
- 1.06 DELIVERY AND STORAGE: Deliver materials to the job site in the manufacturer's external shipping containers, unopened, with brand names, date of manufacture, color, and materials designated clearly thereon. Containers of elastomeric sealant shall be labeled as to type, class, grade and use. Carefully handle and store all materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 degrees Fahrenheit or less than 40 degrees Fahrenheit.
- 1.07 WARRANTY:
- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

- 2.01 MATERIALS: Products shall conform to the reference documents listed for each use. Color of sealant and caulking shall match adjacent surface color unless specified otherwise. For ASTM C920 sealants, use a sealant that has been tested on the type(s) of substrate to which it will be applied.

- A. Interior Caulking or Sealant: ASTM C920, Type S, Grade NS, Class 12.5 or 25, Use NT. Color of caulking or sealant shall be white.
- B. Exterior Sealant: For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be gray unless in contact with window frame where it shall be dark brown or bronze.
- C. Exterior sealants used adjacent to or above roof surfaces shall be compatible with asphaltic bituminous roofing products, should contact be made with the roofing system, that would not have adverse affects to either product.
- D. Floor Joint Sealant: ASTM C920, Type M, Grade P, Class 25, Use T. Color of sealant shall be gray.
- E. Primer for Sealant: Use a non-staining, quick-drying, of type and consistency as recommended by the sealant manufacturer for the particular application.
- F. Bond Breakers: Use the type and consistency recommended by the sealant manufacturer for the particular application.
- G. Backstops: Use a closed cell polyurethane or polyethylene foam free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

PART 3 - EXECUTION

3.01 **SURFACE PREPARATION:** Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of 1/2-inch and grind to a minimum width of 1/4-inch without damage to the adjoining work. No grinding shall be required on metal surfaces.

- A. Steel Surfaces: Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a solvent that leaves no residue.
- B. Aluminum or Bronze Surfaces: Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. Use non-staining solvents recommended by the item manufacturer.

3.02 **SEALANT PREPARATION:** Do not modify the sealant by addition of liquids, solvents or powders. Mix multi-component elastomeric sealants in accordance with manufacturer's printed instructions.

3.03 **APPLICATION:**

- A. Backstops: Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.
- B. Primer: Just prior to application of the sealant or caulking compound, clean out all loose particles from joints. Apply primer in accordance with compound manufacturer's directions. Do not apply primer to exposed finish surfaces.
- C. Bond Breaker: Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.
- D. Sealant and Caulking Compounds: Use a compound that is compatible with the material to and against which it is applied. Do not use a compound that has exceeded its shelf life or has become too jelled to

be discharged in a continuous flow from the gun. Apply the compound in accordance with the manufacturer's printed instructions. Force the compound into joints with sufficient pressure to fill the joints solidly. Compound shall be uniformly smooth and free of wrinkles.

1. Interior Sealant and Caulking: Provide sealant or caulking at all exposed joints in the building and at all joints indicated to receive sealants or caulking.
2. Exterior Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints on the building and at all joints indicated to receive sealant.
3. Floor Joint Sealant: Provide sealant in all control joints and in other floor joints indicated or specified.

3.04 PROTECTION AND CLEANING:

- A. Protection: Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.
- B. Cleaning: Immediately scrape off fresh compound that has been smeared on masonry and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of compound application, remove all remaining smears and stains resulting therefrom and leave the work in a clean and neat condition.

END OF SECTION

SECTION 07921 JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY: This Section includes sealants and related materials for application in the joint locations specified in PART 2.

1.02 REFERENCES:

A. Applicable Standards:

1. American Society for Testing and Materials (ASTM):
 - a. C920 - Elastomeric Joint Sealants.
 - b. C962 - Guides for Use of Elastomeric Joint Sealants.
 - c. E814 - Test Methods for Fire Tests for Through-Penetration Fire Stops.

1.03 SUBMITTALS:

A. Submit as specified in DIVISION 1.

B. Includes, but not limited to, the following for each type of sealant or associated material required.

1. Product data and specifications including instructions for joint preparation and sealer application.
2. Color charts.
3. Samples for initial selection purposes: Submit samples consisting of strips of actual product showing full range of colors available, for each type of sealant exposed to view.

C. Certificates: Review the joint design and specifications and verify that the joint system is appropriate for its location and that sealant materials comply with specifications.

1.04 QUALITY ASSURANCE:

A. Manufacturer of sealants shall have a minimum of 5 years of successful experience in the production of types of sealants required.

B. Sealant installer shall be certified by the sealant manufacturer as having the necessary experience and equipment to install the materials properly.

C. Obtain joint sealant materials from a single manufacturer for each different product required.

D. Preconstruction Compatibility and Adhesion Testing: Submit samples of all materials that will contact or affect joint sealers to joint sealer manufacturers for compatibility and adhesion testing, as indicted below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates.
2. Perform tests under normal environmental conditions that will exist during actual installation.
3. Investigate materials failing compatibility or adhesion tests and obtain joint sealer manufacturer's written recommendations for corrective measures, including use of specially formulated primers.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver all materials in original sealed containers or bundles with labels and inscriptions legible and intact, and informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store all materials in areas suitable to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 degrees F. (4.4 degrees C.).
 - 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.
- D. Proceed with application only when forecasted weather conditions is favorable for proper cure and development of bond strength.

1.07 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer listed under each type of material is to establish minimum quality and specific type. Equivalent products of manufacturers listed below will be acceptable subject to suitability for intended condition.
 - 1. Sealants and Caulking:
 - a. Bostik Construction Products Div.
 - b. Pecora Corporation
 - c. Sonneborn Building Products
 - d. Tremco Manufacturing Company
 - e. W. R. Meadows, Inc.

2.02 GENERAL:

- A. Before purchase of each specified sealant, investigate its compatibility with the joint surfaces, joint fillers, and other materials in the joint system. Select materials for compatibility with joint surfaces

and other indicated exposures, and except as otherwise indicated select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

B. Provide colors as selected by the DISTRICT from manufacturer's standard colors.

2.03 ELASTOMERIC SEALANTS:

A. Sealants conforming to equivalent Federal Specifications will be acceptable.

1. One-Component Urethane Sealant: (Use NT)

- a. Conform to ASTM C920, Type S, Grade NS, Class 25. Use classification as required by locations stated below.
- b. Manufacturer: Pecora Dynatrol I or Tremco Dymonic
- c. Use in the following locations:
 - i. Exterior and interior joints around perimeter of doors and louver frames.
 - ii. Thresholds
 - iii. Joints between gypsum board and precast concrete.
 - iv. Penetrations in exterior wall (both sides of wall) by piping, conduit and other service equipment. (Does not include generator exhaust opening).
 - v. Perimeter of stainless steel plate at pipe wall sleeves.

2.04 MISCELLANEOUS MATERIALS:

A. Joint Cleaner: Type as recommended by the sealant manufacturer, for the joint surfaces to be cleaned, which are not harmful to substrates and adjacent surfaces, and which do not leave oily residues or have detrimental effect on sealant adhesion or in-service performance.

B. Joint Primer/Sealer: Type as recommended by the sealant manufacturer, for the joint surfaces to be primed or sealed.

2.05 FORM/SILICONE FIRE STOP SYSTEM:

A. Fire Stop Foam:

1. Medium density, 2-part silicone elastomer with fire resistant properties to meet fire rating of wall, ceiling or floor as indicated.
2. Have ability to form in place and fill complex geometrics to provide a tight, compressive fit.
3. Have ability to be poked through and resealed easily when penetration is modified.

B. Fire Stop Sealant:

1. One part silicone elastomeric sealant with fire resistant properties to meet fire rating of wall, ceiling or floor as indicated, and stop the passage of fire, smoke, fumes and water through the fire-rated penetration.
2. Little or no damming shall be required for small, simple penetrations.

C. Damming and Priming Materials:

1. Include particleboard plywood or other suitable forming materials to contain foam and/or sealant.
2. Provide prime coat for sealant if recommended by manufacturers.

D. Use in the following locations where indicated:

1. All penetrations in partition wall between Generator and Equipment Rooms. Seal from both sides.
- E. Manufacturer:
1. Dow Corning RTV Fire Stop Foam and Fire Stop Sealant.
 2. General Electric TRV 7403 and Pensil 851.

PART 3 - EXECUTION

3.01 JOINT SURFACE PREPARATION:

- A. Joint Cleaning:
1. Clean joint surfaces immediately before application of sealant.
 2. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust, paints (except for permanent protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), oil, grease, waterproofing water repellents, water, surface dirt, and frost.
 3. Clean concrete and similar porous joint surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above operations by vacuuming or blowing out joints with oil-free compressed air.
 4. Remove laitance and form release agents from concrete.
 5. Clean metal and other nonporous surfaces of chemical cleaners or other means that are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- B. Joint Priming: Prime joint substrates as required by joint sealant manufacturer. Confine primers to areas of joint sealer bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use where required to prevent contact of sealant with adjoining surfaces which would otherwise be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.02 APPLICATION:

- A. Conform to sealant manufacturer's printed instructions except where more stringent requirements apply.
1. For elastomeric sealant installation, comply with ASTM C962 for use of joint sealants as applicable to materials, applications and conditions indicated.
- B. Install joint filler units at depth or position in joint to coordinate with other work and sealants. Do not leave voids or gaps between ends of joint fillers. Do not stretch, twist, puncture or tear joint fillers. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry materials.
- C. Install sealants by proven application techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- D. Install sealants to depths as recommended by sealant manufacturer, within the following limitations:
1. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but neither more than 1/2-inch deep nor less than 1/4-inch deep.

- E. Unless indicated otherwise, provide a slightly concave surface conforming to ASTM C962.
- F. Do not allow sealants or compounds to overflow from confines of joint or spill onto adjoining surfaces. Clean the adjoining surfaces to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.
- G. Immediately after sealant installation and prior to time skimming or curing begins, tool nonsag sealants to form smooth uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Remove excess sealant from surfaces adjacent to joint.

3.03 CURE AND PROTECTION:

- A. Cure sealants in compliance with manufacturer's printed instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Cure and protect sealants in a manner that will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants that are damaged or deteriorated during construction period. Repaired areas shall be indistinguishable from original work.

3.04 FIELD QUALITY CONTROL:

- A. After nominal cure of exterior joint sealants which are exposed to weather, test for water leaks as follows:
 - 1. Flood joint exposure with water directed from a 3/4-inch garden hose and connected to water system with 25-psi minimum static water pressure.
 - 2. Hold hose perpendicular to wall face, 2 feet-0 inch from joint, and move stream of water along joint at approximate rate of 20 feet per minute.
- B. Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation as required. Do not perform repair or replacement work until joints are dry.

END OF SECTION

SECTION 09900 PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide coating on exterior and interior surfaces throughout the Project and which are listed in PART 2, with systems specified on "coating system" sheets at the end of this SECTION.
- B. Regulatory Requirements: In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local and regional jurisdiction. Notify the DISTRICT of any coating specified herein that fails to conform to the requirements for the location of the Project or location of application.
 - 1. Lead Content: Use only coatings that are totally lead free.
 - 2. Chromate Content: Do not use coatings containing zinc-chromate or strontium chromate.
 - 3. Asbestos Content: Materials shall not contain asbestos.
 - 4. Mercury Content: Materials shall not contain mercury or mercury compounds.
 - 5. The specified maximum volatile organic compounds (VOC) content shall apply to the unthinned product.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. Division 3 – Concrete

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American National Standards Institute (ANSI):
 - a. A13.1 - Scheme for the Identification of Piping Systems
 - b. Z535.1 - Safety Colors
 - 2. American Society for Testing and Materials (ASTM):
 - a. C267 - Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
 - b. D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
 - c. D4258 - Standard Practice for Surface Cleaning Concrete for Coating
 - d. D4259 - Standard Practice for Abrading Concrete
 - e. D4260 - Standard Practice for Acid Etching Concrete
 - f. D4261 - Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating
 - g. D5201 - Standard Practice for Calculating Formulation Physical Constants of Paints and Coatings
 - h. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

3. Society for Protective Coatings (SSPC) Surface Preparation Specifications:
 - a. SP1 - Solvent Cleaning: Removes oil, grease, soil, drawing and cutting compounds, and other soluble contaminants.
 - b. SP2 - Hand Tool Cleaning: Removes loose mill scale, loose rust, loose paint and other loose foreign matter.
 - c. SP3 - Power Tool Cleaning: Removes loose material. Not intended to remove all scale or rust.
 - d. SP5 - White Metal Blast Cleaning: Removes all scale, rust, foreign matter. Leaves surface gray-white uniform metallic color.
 - e. SP6 - Commercial Blast Cleaning: Two-thirds of each square inch free of all visible residues; remainder only light discoloration.
 - f. SP7 - Brush-Off Blast Cleaning: Removes only loose material, remaining surface tight and abraded to give anchor pattern.
 - g. SP10 - Near-White Blast Cleaning: At least 95% of each square inch shall be free of all visible residues.
 - h. SP11 - Power Tool Cleaning to Bare Metal
4. International Concrete Repair Institute (ICRI)
 - a. Guideline #03732: Surface preparation should comply with ICRI technical guideline number 03732 (selecting and specifying concrete surface preparation for sealers, coatings and polymer overlays).
5. United States Army Corps of Engineers (USACE)
 - a. CRD-C 48 - Standard Test Method for Water Permeability of Concrete

1.03 DEFINITIONS:

- A. Coating systems include surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied may be specified elsewhere or referenced to this SECTION so that a complete system is specified and coordinated.
 1. Where surface preparation and first (prime) coat are specified in other SECTIONs to be shop-applied, such as for structural steel, hollow metal doors or equipment, only the touch-up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
 2. If materials are provided without shop primer such as miscellaneous steel or sheet metal, then surface preparation, first, second, and third coats are a part of field painting.
 3. Concealed surfaces are generally not required to have finish-coats unless otherwise specified, but prime coat should be applied and touched up prior to concealment.
 4. Where equipment and materials are provided with shop-applied finished coating system, only touch-up is a part of field painting.
 5. Refer to applicable SECTIONs to determine whether surface preparation and first coat, or complete coating system, is to be shop-applied.
 6. The term "DFT" means minimum dry film thickness, with no tolerance for thinner films.

1.04 SUBMITTALS:

- A. Submit as specified in SECTION 01300.

- B. Submittals include, but are not limited to, the following:
1. Schedule of products and paint systems to be used. Schedule shall include the following information:
 - a. Surfaces for system to be applied
 - b. Surface preparation method and degree of cleanliness
 - c. Product MANUFACTURER, name, and number
 - d. Method of application
 - e. Dry film thickness per coat of coating to be applied
 2. Color charts for selection and acceptance
 3. Product information
 - a. MANUFACTURER's data sheet for each product proposed
 - b. Technical and performance information that demonstrates compliance with the system performance and material requirements
 - c. MANUFACTURER's instructions and recommendations on surface preparation and application
 - d. Compatibility of shop and field applied coatings (where applicable)
 - e. Material Safety Data Sheet (MSDS) filled out completely according to the Florida Right-to-Know Law, Chapter 442, Florida Statutes, clearly identifying each product used.
 4. Certification signed by coating MANUFACTURERS stating that each coating is suitable for service intended as stated on each coating system sheet, and that the materials to be installed comply in all respects with the requirements of this SECTION.
 5. The CONTRACTOR shall certify in writing to the DISTRICT that applicators have previously applied all the systems in this SECTION and have the ability and equipment to prepare the surfaces and apply the coatings correctly.
 6. Samples
 - a. Painted Wood: Eight (8) inch square samples for each color and material on hardboard.
 - b. Sample of each paint, finish, and other coating material on 8-1/2 inch by 11-inch sheet metal. Each sheet shall be completely coated over its entire surface with one coating material, type, or color.
 - c. Two (2) sets of color samples that match each color selected by the DISTRICT from the MANUFACTURER's color charts. The color designation shall be shown on the back of the color sample.
 - d. Two (2) 2-foot by 2-foot concrete panels shall be constructed at the Site in an area designated by the DISTRICT. On one panel, the CONTRACTOR shall apply the coating system required for water-retaining concrete interior surfaces and the system for concrete exterior surfaces on the other panel. The CONTRACTOR shall not begin coating the structure surfaces until the DISTRICT has accepted both panels. If the DISTRICT does not approve either panel, at its own expense the CONTRACTOR shall erect another, coat it, and request DISTRICT approval.

1.05 QUALITY ASSURANCE:

- A. Applicator Qualifications:
1. Coating WORK shall be performed by an SSPC certified CONTRACTOR having a minimum of Category QP 1 certification for WORK without hazardous paint removal, and Category QP 2

certification for WORK involving hazardous paint removal. The certified CONTRACTOR shall maintain in effect all required certifications for the duration of the Project. Any request for Project delay due to an expired certification will not be considered.

2. The applicator shall be certified in application of specified products and systems on projects of similar size and scope, as demonstrated by previous successful installations, and shall be approved by the MANUFACTURER in writing.
- B. Manufacturer:
1. Provide products of MANUFACTURER with no less than ten (10) years experience in manufacturing the materials for the required WORK.

1.06 RESPONSIBILITIES: (Not Used)

1.07 INSPECTION COORDINATION:

- A. Pre-painting Conference:
1. Before field painting starts, representatives for the DISTRICT, CONTRACTOR, coating applicator, and coating MANUFACTURER's technical representative shall meet with the DISTRICT's personnel.
 2. Agenda for the meeting will include details of surface preparations and coating systems to ensure understanding and agreement by all parties for compliance.
- B. In the event a problem occurs with coating system, surface preparation, or application, coating applicator and coating MANUFACTURER's technical representative shall promptly investigate the problem and submit results to the DISTRICT.
- C. Whenever water tightness in a water-retaining structure is dependent upon WORK in other sections, the CONTRACTOR shall assume full responsibility for water tightness of the integrated assembly. Prior to starting WORK, CONTRACTOR shall meet with installers involved and with MANUFACTURERs of all materials involved to review Drawings and Specifications to insure that materials are being used properly and details are correct. A written report of this meeting shall be submitted to the DISTRICT. The report shall contain at least:
1. Meeting date and names and affiliations of those present and written statements from each installer and MANUFACTURER of their acceptance of Drawings, Specifications and conditions, and of proposed use of their materials as proper for purposes shown.

1.08 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS, and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER's standard warranty, but for no less than five (5) years from the date of Substantial Completion, and as described in the Contract Documents. If the MANUFACTURER's standard warranty is less than the stipulated period, the MANUFACTURER shall provide a special MANUFACTURER's extended warranty for the stipulated period, or a Maintenance Bond, to extend the MANUFACTURER's warranty period for the stipulated period.
- B. The CONTRACTOR shall warranty the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Proprietary names and product numbers are specified in most systems for material identification from these MANUFACTURERS.
1. PPG (Pittsburg Plate Glass Co.)
 2. Carboline Company, Inc.
 3. BASF Building Systems
 4. ICI Devoe Coating Company
 5. The Euclid Chemical Company
 6. Tnemec Company, Inc.
 7. Xypex Chemical, Ltd.
 8. Kryton International
 9. Sika Corporation
 10. GML Coatings, LLC
 11. Wasser Corporation
 12. Xymax Coatings, Inc.
 13. Benjamin Moore & Company
 14. Sherwin-Williams
 15. PPC Coatings
 16. International Fire Resistant Systems, Inc.

2.02 GENERAL:

- A. Materials furnished for each coating system must be compatible with the substrate.
- B. Single Manufacturer: All materials in each coating system shall be by the same coating MANUFACTURER to assure compatibility of coatings.
- C. Compatibility: When shop-painted surfaces are to be field coated, the CONTRACTOR shall ascertain whether finish materials will be compatible with shop coating. Coatings of uncertain composition shall be removed completely before applying new coatings.
- D. Colors:
1. Color of finish coatings shall match accepted color samples.
 2. When second and finish coats of a system are of same type, CONTRACTOR shall tint or use an easy distinguishable alternate color on second coat to enable visual coverage inspection of the third coat. When first and second coats only are specified and are of same or different types, tint or use an easy distinguishable alternate color on first coat to enable visual coverage inspection of the second coat.
- E. Include on label of material containers:
1. MANUFACTURER's name, product name, and number
 2. Type of paint and generic name
 3. Color name and number
 4. Storage and temperature limits
 5. Mixing and application instructions, including requirements for precautions which must be taken
 6. Drying, recoat, or curing time

2.03 COATING SYSTEMS: Specified on the "Coating System" sheets at the end of this SECTION.

2.04 SURFACES TO BE COATED:

- A. Exterior Surfaces: All exterior surfaces extending one (1) foot above the maximum surface water level and those that are submerged in fresh water or brackish water shall be provided with the following additional protective measures:

| <u>Generic Description</u> | <u>Specific Surfaces</u> | <u>System</u> |
|---|--|----------------------|
| Steel, mild exposure, non-immersion, Interior | 1. Hollow metal doors and frames 2. Miscellaneous steel | S-1 |
| Steel, severe exposure, non-immersion, exterior or interior, where only marginal cleaning can be performed | 1. Miscellaneous exposed steel surfaces | S-2 |
| Steel equipment, prime coated, severe exposure, non-immersion, interior and exterior | 1. Carbon steel in fabricated equipment for gate hoists and machinery | S-3 |
| Steel and non-ferrous metal, severe exposure, buried and immersed, interior of tank, and piping and equipment immersed in tank or basin | 1. Roller gates and associated steel 2. Steel Sheet Piling, Walls | S-4 |
| Steel, surface temperatures between 350 and 1000 degrees F continuous | 1. Exhaust piping and silencer | S-5 |
| Steel tank exterior, severe UV exposure | 1. Steel Tanks | S-6 |
| Steel, severe Exposure, Non-Immersion. Exterior or Interior. DTM Acrylic. Safety Yellow. | 1. Bollards, guard posts 2. Natural gas lines, diesel fuel lines 3. Crane Bridge | S-7 |
| Concrete and concrete masonry units (CMU), mild exposure, non-immersion, interior and exterior | 1. Precast Concrete Control Structure | C-1 |
| Concrete and concrete masonry units, severe exposure, non-immersion, interior | 1. Miscellaneous concrete walls | C-2 |
| Water-retaining concrete structures, interior and exterior (waterproofing) , non-immersion | 1. Channel walls 2. Intake & Discharge Bays | C-3 |
| Water-retaining concrete structures, interior and exterior below water level; protection against acid producing bacteria and other elements | 1. Water Control Structures 2. Pump Stations | C-4 |
| Gypsum board, mild exposure, interior | 1. Interior walls | W-1 |
| Exterior wood | 2. Sign posts | W-2 |
| Plywood | 3. Plywood back boards (IT Shelter) | W-3 |
| Aluminum in contact with concrete or any other metal except galvanized steel | 1. Conduits, pipes, and plates | A-1 |

2.05 **SURFACES NOT TO BE COATED:**

- A. Factory finished equipment, except for touch-up or noted otherwise
- B. Metal surfaces of stainless steel, bronze, aluminum, and fiberglass
- C. Concrete, unless listed on specific surfaces above
- D. Machined surfaces

- E. Grease fittings
- F. Glass
- G. Equipment nameplates
- H. Platform gratings, stair treads, door thresholds, and other walking surfaces unless listed on specific surfaces above
- I. Concrete Floors unless listed above

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING:

- A. Manufacturer Recommendations: Unless this specification requires otherwise, CONTRACTOR shall strictly follow the MANUFACTURER's printed recommendations and instructions for storing and handling coating system materials.
- B. Delivery of Materials:
 - 1. Deliver in sealed containers with labels and information legible and intact. Containers shall also have correct labels with required information.
 - 2. CONTRACTOR shall allow sufficient time for testing, if required.
- C. Storage of Materials: CONTRACTOR shall store under conditions recommended by the Material Safety Data Sheets:
 - 1. All protective coating materials shall be used within the MANUFACTURER's recommended shelf life.
 - 2. Store only acceptable materials on Project Site.
 - 3. Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures. Provide separate area and suitable containers for storage of coatings and related coating equipment.
 - 4. Dispose of used or leftover containers, thinners, rags, brushes, and rollers in accordance with applicable regulations.

3.02 PREPARATION FOR COATING:

- A. General: All surfaces to receive protective coatings shall be clean prior to application of coatings. The CONTRACTOR shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust.
- B. Protection of surfaces not to be coated: Surfaces that are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.
- C. Hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked, or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.
- D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible

for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

- E. Protection of painted surfaces: Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

3.03 SURFACE PREPARATION:

A. General

1. Prepare surfaces for each coating system conforming to SSPC or ASTM surface preparation specifications listed.
 - a. If grease or oils are present, SSPC-SP1 must precede any other method specified.
 - b. Remove surface irregularities such as weld spatter, burrs, or sharp edges, prior to specified surface preparation.
2. Depth of profile shall be as specified for each system, but in no instance shall it exceed one-third of the total dry-film thickness of complete system.
3. Prepare only those areas which will receive the first coat of the system on the same day.

B. Metals

1. The minimum abrasive blasting surface preparation shall be as indicated in the coating system sheets included at the end of this Section. Where there is a conflict between these specifications and the coating MANUFACTURER's printed recommendations for the intended service, the higher degree of cleaning shall apply.
2. All sharp edges shall be rounded or chamfered, and all burrs, surface defects, and weld splatter shall be ground smooth prior to blast cleaning.
3. The type and size of abrasive shall be selected to produce a surface profile that meets the system sheet requirements for the particular coating and service conditions. Abrasives for submerged and severe service coating systems shall be clean, hard, sharp cutting crushed slag. Automated blasting systems shall not be used for surfaces that will be in submerged service. Metal shot or grit shall not be used for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned to be one with hard, sharp cutting crushed slag.
4. Abrasive shall not be reused unless an automated blasting system is used for surfaces that will be in non-submerged service. For automated blasting systems, clean oil-free abrasives shall be maintained. The abrasive mix shall include at least 50 percent grit.
5. The CONTRACTOR shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.
6. Compressed air for air blast cleaning shall be supplied at adequate pressure from well maintained compressors equipped with oil and moisture separators that remove at least 95 percent of the contaminants.
7. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another method prior to painting.
8. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.
9. Damaged or defective coating shall be removed by the blast cleaning to meet the clean surface requirements before recoating.
10. If the required abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC SP2 or SSPC SP3 may be used.

11. Shop applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC SP1 before the abrasive blast cleaning work is started.
12. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

C. Concrete and Concrete Masonry Units

1. Surface preparation shall not begin until at least 30 days after the concrete or masonry has been placed.
2. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC SP1 before abrasive blast cleaning.
3. Concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 80 grit flint sandpaper, if required by the coating application instructions.
4. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, CONTRACTOR shall rinse surfaces with water and test the pH. The pH shall be between neutral and eight (8).
5. Surfaces shall be clean and as recommended by the coating MANUFACTURER before coating is started.
6. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or equal.
7. Designer shall determine if chemical testing and treatment of microbial/chemical attack is needed to prepare surface.

3.04 APPLICATION:

- A. CONTRACTOR shall apply coatings in accordance with coating MANUFACTURER's recommendations. Materials shall be thoroughly stirred, strained, and kept at uniform consistency during application. Coatings from different MANUFACTURERS shall not be mixed together.
- B. Use properly designed brushes, rollers, and spray equipment for all applications.
- C. On unprimed surfaces apply first coat of the system the same day as surface preparation.
- D. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The CONTRACTOR shall schedule such inspection with the DISTRICT in advance.
- E. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.
- F. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.
- G. Dry-film thickness of each system shall be at least as thick as the minimum specified. Maximum dry-film thickness shall not exceed the minimum more than 20% or coating MANUFACTURER's requirements, whichever is less. Where a dry-film thickness range is specified, the thickness shall not be shall not be outside the range.
- H. Shop and field painting shall not be applied within three (3) inches of unprepared surface of any substrate such as areas to be welded or bolted.

I. Environmental Conditions:

1. Atmospheric temperature must be 50 degrees Fahrenheit or higher during application, unless approved in writing by coating MANUFACTURER. Do not apply coatings when inclement weather or freezing temperature may occur during the curing time interval.
2. Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating MANUFACTURER's limits.
3. Relative humidity must be less than 85% and the temperature of the surface to be painted must be at least five (5) degrees above the dew point.
4. Provide adequate ventilation in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the MANUFACTURER's Material Safety Data Sheets for the specific coatings being applied.

J. Recoat Time: In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the previously applied coating in accordance with MANUFACTURER's recommendations.

K. Protection:

1. Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
2. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.
3. Provide cover or shields to prevent surface preparation media and coatings from entering orifices in electrical or mechanical equipment. Where ventilation systems must be kept in operation at time of surface preparation, take precautions to shield intakes and exhausts to prevent the materials from entering system or being dispersed.
4. Provide signs to indicate fresh paint areas.
5. Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers that cannot be reused in accordance with applicable regulations.
6. Do not remove or paint over equipment data plates, code stamps on piping, or UL fire-rating labels.

3.05 INSPECTION:

A. CONTRACTOR shall provide and use a wet-film gauge to check each application approximately every fifteen (15) minutes in order to immediately correct film thickness under or over that specified.

B. On ferrous surfaces, measurements shall be made with one of the thickness gauges listed below. The gauge shall be calibrated on metal practically identical in composition and surface preparation to that being coated and be of substantially the same thickness, except that for measurements on metal thicker than 1/4 inch, the instrument may be calibrated on metal with a minimum thickness of 1/4 inch. When calibrating any of the gauges for making film measurements of over three (3) mils, the calibrating thickness standards (shims) shall be of non-metallic composition. Where only one thickness criterion is specified, the calibrating shim thickness shall closely approximate the specified thickness, but where both thicknesses are specified, the shim's thickness shall closely approximate an average of the two. Calibrating instructions, thickness standards and, in the case of the Mikrotest gauge, a calibrating tool, should be obtained from the MANUFACTURER or supplier of the gauge. Authorized thickness gauges are:

1. General Electric, Type B, General Electric Company
2. Mikrotest, Elektrophysik - Koln
3. Elcometer, Elcometer Instruments, Ltd.

4. Inspector Gage, Elcometer Instruments, Ltd.
 5. Minitector, Elcometer Instruments, Ltd.
- C. Use holiday or pinhole detector on systems over metal substrates to detect and correct voids when indicated on system sheet.
 - D. Furnish a sling psychrometer and perform periodic checks on both relative humidity and temperature limits.
 - E. Check temperature of the substrate at regular intervals to be certain surface is five (5) degrees Fahrenheit or more above the dew point.
- 3.06 CLEANING AND REPAIRS:
- A. Remove spilled, dripped, or splattered paint from surfaces.
 - B. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.

END OF SECTION

| | | |
|---|---|--|
| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, FL 33406</p> | PROTECTIVE COATING SYSTEM | |
| | System S-1 | |
| <p><u>SERVICE:</u> Steel, Mild Exposure, Non-Immersion, Interior</p> <p>Surface Preparation: Field: SSPC-SP1 and SP6. Clean and dry.</p> <p>First Coat: High solids polyamine or polyamide epoxy with minimum 67% solids by volume. Spray Applications; apply at 5.0 - 8.0 mils DFT. Brush applications, apply at 4.0 mils DFT.</p> <p>Second Coat: Same as first coat. Note: Second coat required only for brush applications.</p> <p>Third Coat (Exterior): Not required.</p> <p>System Total: Minimum 8.0 mils dry film thickness.</p> <p>Volatile Organic Content: Maximum 3.5 lbs/gal (425 g/l).</p> | | |
| COATING MANUFACTURER | PRODUCT DESIGNATION | |
| PPGCarboline ICI Devoe Tnemec Sherwin-Williams | FIRST COAT Amerlock 2/400 Carboguard 890 Devran 224HS Hi-Build Epoxoline II N69 Macropoxy 646 FC(5-8mils DFT) | SECOND COAT Same as first coat Same as first coat Same as first coat Same as first coat Same as first coat |

| | | | |
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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | <p>PROTECTIVE COATING SYSTEM</p> | | |
| | <p>System S-2</p> | | |
| <p><u>SERVICE:</u> Steel, Severe Exposure, Non-Immersion, Exterior or Interior, where only marginal cleaning can be performed</p> <p>Surface Preparation: Field: SSPC-SP1 and SP3. Clean and dry.</p> <p>First (prime) Coat: Polyamidoamine epoxy with wetting and penetrating properties and with 98% solids by volume. Apply at 1.5 to 2.0 mils dry film thickness.</p> <p>Second Coat: High build polyamide epoxy with minimum 65% solids by volume. Apply at 5.0 mils dry film thickness.</p> <p>Third Coat (Exterior): High solids aliphatic or acrylic polyurethane gloss enamel with minimum 65% solids by volume. Apply at 2.0 mils dry film thickness.</p> <p>System Total: Minimum 8.5 mils dry film thickness, Exterior. Minimum 6.5 mils dry film thickness, Interior.</p> <p>Volatile Organic Content: Maximum 2.8 lbs/gal (340 g/l).</p> | | | |
| <p>COATING MANUFACTURER</p> | <p>PRODUCT DESIGNATION</p> | | |
| <p>Carboline ICI Devoe Tnemec PPG Sherwin-Williams</p> | <p>FIRST COAT Carboguard 890 Bar-Rust 231 Chembuild 135 Amerlock 2/400 or Sealer Macropoxy 646 FC</p> | <p>SECOND COAT Same as first coat Devran 224HS Not Applicable Amerlock 2/400 Same as first coat</p> | <p>THIRD COAT Carboline 133HB Devthane 379H Endura-Shield 1074 Amercoat 450H Acrolon 218 HS Polyurethane</p> |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | <p>PROTECTIVE COATING SYSTEM</p> | | |
| | <p>System S-3</p> | | |
| <p><u>SERVICE:</u></p> <p>Surface Preparation:</p> <p>First Coat: (Field)</p> <p>Second Coat Interior:</p> <p>Second Coat Exterior:</p> <p>System Total:</p> <p>Volatile Organic Content:</p> | <p>Equipment, Factory Coated, Severe Exposure, Non-Immersion, Exterior or Interior</p> <p>Field or Shop (if applicable) First Coat: SSPC-SP1 and SP6. Clean and dry.</p> <p>Modified vinyl-alkyd or epoxy-mastic, compatible with existing and new finish. Apply at 1.5 to 2.0 mils dry film thickness.</p> <p>High build polyamide epoxy with minimum 50% solids by volume. Apply at 5.0 mils dry film thickness.</p> <p>High solids aliphatic or acrylic polyurethane gloss enamel with minimum 52% solids by volume. Apply at 2.0 mils dry film thickness.</p> <p>Interior: 6.5 mils dry film thickness in addition to existing coating. Exterior: 3.5 mils dry film thickness in addition to existing coating. Check for voids with holiday or pinhole detector.</p> <p>Maximum 3.5 lbs/gal (425 g/l).</p> | | |
| <p>COATING MANUFACTURER</p> | <p>PRODUCT DESIGNATION</p> | | |
| <p>PPG Carboline ICI Devoe Tnemecc Sherwin-Williams</p> | <p>FIRST COAT Amercoat 385 or 2/400 Carbomastic 15 Bar-Rust 231 Omnithane 1 Kem Kromlik Primer</p> | <p>SECOND COAT (INT) Same as first coat Carboguard 890 Devran 224 HS Hi-Build Epoxoline II N69 Macropoxy 646C</p> | <p>SECOND COAT (EXT) Amercoat 450H Carboline 134 HG Devthane 379H Endura-Shield 1074 Acrolon 218 HS Polyurethane</p> |

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| South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406 | | PROTECTIVE COATING SYSTEM | |
| | | System S-4 | |
| <u>SERVICE:</u> | | Steel and Non-Ferrous Metals, Severe Exposure. Buried and Immersed, Interior of Tank, Piping or Equipment Immersed in Tank or Basin. | |
| Surface Preparation: | | SSPC-1 to remove all grease and oils, soluble salt removal (if necessary) SSPC-5 (white metal) to achieve a surface profile of 1.0 – 2.0 mils | |
| First Coat: | | Moisture Cured Urethane Zinc Primer without MIO | |
| Second Coat: | | Moisture Cured Urethane Coal Tar | |
| Third Coat: | | Same as second coat. | |
| System Total: | | Minimum 15.00 mils dry film thickness. Check for voids with holiday or pinhole detector. | |
| Volatile Organic Content: | | Maximum 2.8 lbs/gal (340 g/l). | |
| COATING MANUFACTURER | | PRODUCT DESIGNATION | |
| Wasser Coatings Sherwin-Williams Tnemec Xymax | | FIRST COAT MC-Zinc Zinc Clad 221MCU Zinc Tneme-Zinc 90-1K97 Mono Zinc Ultra 2401 | SECOND COAT MC-Tar Corothane I Coal Tar Black Omnithane Hydrocarb X 546 Mono Guard 6201 |
| | | THIRD COAT Same as second coat Same as second coat Same as second coat Same as second coat | |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | PROTECTIVE COATING SYSTEM | |
| | System S-5 | |
| <p><u>SERVICE:</u></p> <p>Surface Preparation:</p> <p>First Coat:</p> <p>Second Coat:</p> <p>Third Coat:</p> <p>System Total:</p> <p>Volatile Organic Content:</p> | <p>Steel, Surface Temperatures 350 to 1000 degrees F, Continuous</p> <p>Shop or Field First Coat: SSPC-1, SP10, and profile depth 1 mil.</p> <p>Field Touch-Up: SSPC-6 and profile depth 1 mil.</p> <p>Silicone aluminum. Aluminum or grey color. Apply at 1.0 to 1.5 mils dry film thickness, or greater as required by manufacturer.</p> <p>Same as first coat.</p> <p>Not required.</p> <p>Minimum 2.0 to 3.0 mils dry film thickness.</p> <p>Maximum 5.2 lbs/gal (623 g/l).</p> | |
| COATING MANUFACTURER | PRODUCT DESIGNATION | |
| PPG Carboline Devoe Tnemec Sherwin-Williams | <p align="center">FIRST COAT</p> Amercoat 878 Carbozinc 11 HT-12 Silicone Aluminum 39-1261 TemperKote 1000 | <p align="center">SECOND COAT</p> Amercoat 873878 Thermaline 4700 Aluminum Same as first coat Same as first coat Same as first coat |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | <p align="center">PROTECTIVE COATING SYSTEM</p> | | |
| | <p align="center">System S-6</p> | | |
| <p><u>SERVICE:</u> Steel tank exterior, severe UV exposure</p> <p>Surface Preparation: SSPC-SP-6, commercial blast clean</p> <p>First Coat: single component, zinc rich moisture cure urethane, 4 mils</p> <p>Second Coat: single component moisture cure urethane, 4 mils</p> <p>Third Coat: single component moisture cure urethane, gloss, 2 mils</p> <p>System Total: 10 mils</p> <p>Volatile Organic Content: 2.8 lb per gal (340 g/L)</p> | | | |
| <p>COATING MANUFACTURER</p> | <p align="center">PRODUCT DESIGNATION</p> | | |
| <p>Wasser Coatings Sherwin Williams PPG</p> | <p>FIRST COAT MC-Zinc Corothane I Zinc Primer Durathane MCZ</p> | <p>SECOND COAT MC-CR Corothane I HS Aliphatic Amerlock 2/400</p> | <p>THIRD COAT MC-Shieldcoat Same as 2nd coat Amercoate 450H</p> |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | <p>PROTECTIVE COATING SYSTEM</p> | |
| | <p>System S-7</p> | |
| <p><u>SERVICE:</u> Steel; Severe Exposure, Non-Immersion. Exterior or Interior. DTM Acrylic. Safety Yellow.</p> <p>Surface Preparation: SSPC-SP1 and SP6. Clean and dry.</p> <p>First Coat: Direct to Metal Acrylic Safety Yellow. Apply a minimum of 2.5 mils dry film thickness, or greater as required by MANUFACTURER.</p> <p>Second Coat: Same as first coat.</p> <p>Third Coat: Not required.</p> <p>System Total: 5.0 mils dry film thickness.</p> <p>Volatile Organic Content: Maximum 2.08 lb per gal (< 250 g/L)</p> | | |
| <p>COATING MANUFACTURER</p> | <p>PRODUCT DESIGNATION</p> | |
| <p>Benjamin Moore & Co. Sherwin-Williams</p> | <p>FIRST COAT DTM Acrylic Gloss Enamel P28-15 B66Y37 DTM Acrylic Gloss</p> | <p>SECOND COAT Same as 1st coat Same as 1st coat</p> |

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| <p>South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | <p>PROTECTIVE COATING SYSTEM</p> |
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| | | System C-1 | | |
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| <u>SERVICE:</u> | | Concrete walls (interior), CMU walls (interior & exterior), and precast walls with a finned or textured concrete surface (exterior), Mild Exposure, Non-Immersion, | | |
| Surface Preparation: | | Concrete: ASTM D 4258, clean and dry, free from grease, oil, and any other contamination. Remove protrusions. Fill pits in concrete with patching compound as recommended by coating MANUFACTURER. CMU: ASTM D 4261, clean and dry, free from grease, oil, and any other contamination. Remove protrusions. | | |
| First Coat: | | Acrylic Latex block filler with minimum 44% solids by volume. Apply at approximately 800 square feet per gallon on concrete and as required to fill pores on CMU. | | |
| Second Coat: | | Water reducible acrylic coating with minimum 34% solids by volume, gloss finish. Apply at 2.0 mils dry film thickness. | | |
| Third Coat: | | Same as second coat. | | |
| System Total: | | Minimum 4.0 mils dry film thickness in addition to filler. | | |
| Volatile Organic Content: | | Maximum 2.8 lbs/gal (340 g/l). | | |
| COATING MANUFACTURER | | PRODUCT DESIGNATION | | |
| | | FIRST COAT | SECOND COAT | THIRD COAT |
| PPG | | PermaCrete 4-100 | PittTech | PittTech |
| Carboline | | Carbocrylic 650/120 | Carbocrylic 3359 | Same as second coat |
| ICI Devoe | | Bloxfil 4000 | Devflex 4208 | Same as second coat |
| Tnemec | | Envirofill 130 | Tneme-Cryl 6 | Same as second coat |
| Sika Corporation | | Sikagard 62 | Sikagard 62 | Same as second coat |
| Sherwin-Williams | | CementPlex 875 | DTM Primer Finish | Same as second coat |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | PROTECTIVE COATING SYSTEM | | |
| | System C-2 | | |
| <u>SERVICE:</u> | Concrete and Concrete Masonry Units, Severe Exposure, Non-Immersion, Interior | | |
| Surface Preparation: | <p>Concrete: ASTM D4258, clean and dry, free from grease, oil, and any other contamination. Remove protrusions. Fill pits in concrete with patching compound as recommended by coating MANUFACTURER.</p> <p>CMU: ASTM D 4261, clean and dry, free from grease, oil, and any other contamination. Remove protrusions.</p> | | |
| First Coat: | Sealer and primer as recommended by manufacturer | | |
| Second Coat: | <p>Concrete: High solids epoxy with minimum 75% solids by volume. Apply at 5.0 to 8.0 mils dry film thickness.</p> <p>CMU: High solids epoxy block filler with minimum 60% solids by volume. Apply at 10.0 to 20.0 mils dry film thickness and as required to fill pores.</p> | | |
| Third Coat: | Concrete & CMU: High solids epoxy with minimum 75% solids by volume. Apply at 5.0 to 8.0 mils dry film thickness. Semi-gloss or gloss finish. | | |
| System Total: | <p>Concrete: Minimum 10.0 mils dry film thickness.</p> <p>CMU: Minimum 15.0 mils dry film thickness.</p> | | |
| Volatile Organic Content: | Maximum 3.5 lbs/gal (425 g/l). | | |
| COATING MANUFACTURER | PRODUCT DESIGNATION | | |
| PPG Carboline ICI Devoe Tnemec Sika Corporation Wasser Coatings Sherwin-Williams | FIRST COAT See * note below Carboguard 1340 Pre-Prime 167 H.S Epoxy 104 Sikagard 62 MC-CR 100^ Corobond 100** | SECOND COAT Amerlock 2/400 Carboguard 890 Devran 224 HS HS Epoxy 104 Sikagard 62 MC-CR Macropoxy HS Epoxy (80%) Kem Cati Coat Epoxy Block Filler-CMU | THIRD COAT same as second coat Carboguard 890 or 891 Devran 224 HS H.S. Epoxy 104 Same as second coat MC-Luster (semi-gloss) Same as second coat |
| <p><u>Notes:</u> *Use Amerlock Sealer for concrete, and Permacrete 4-100 for masonry units **Epoxy Primer ^ thinned 20%</p> | | | |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | <p align="center">PROTECTIVE COATING SYSTEM</p> | |
| <p><u>SERVICE:</u> Water -Retaining Concrete Structures, Interior and Exterior (waterproofing), Non-immersion</p> <p>Surface Preparation: Per MANUFACTURER recommendations</p> <p>First Layer: (Interior) Two coats of cementitious crystalline coating containing catalytic chemicals which migrate into the concrete using moisture present in the concrete as the migrating medium, and which cause the moisture and the unhydrated cement in the concrete to react causing the growth of nonsoluble crystals, thereby rendering the concrete itself waterproof. The concrete becomes permanently sealed against the penetration of liquids from any direction.</p> <p>(Exterior) breathable high-build, waterproof cement-based coating. Bonding agent shall be mixed with the coating to improve adhesion to substrate.</p> <p>Second Layer: (Exterior) Two coats of a breathable, water based, acrylic emulsion coating that will resist ultraviolet light, alkali, acid, and mildew</p> <p>Third Coat: Not required</p> <p>System Total Thickness: As MANUFACTURER recommends</p> <p>Crystallizing capability of waterproofing material shall be evidenced by independent SEM (Scanning Electron Microscope) photographs documenting penetration of crystal-forming waterproofing material to a depth of 2 inches.</p> <p>Independent testing shall be performed for 1. Permeability in accordance with USACE CRD C48 to a pressure of 175 psi with no measurable leakage exhibited and 2. Chemical resistance in accordance to ASTM C267.</p> | <p align="center">System C-3</p> | |
| <p align="center">COATING MANUFACTURER</p> | <p align="center">PRODUCT DESIGNATION</p> | |
| <p>Xypex Chemical, Ltd BASF Building Systems Kryton International</p> | <p>FIRST COAT Concentrate Tegraproof Krystol T1</p> | <p>SECOND COAT Modified same as first coat Krystol T2</p> |

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| <p>South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | <p align="center">PROTECTIVE COATING SYSTEM</p> | | |
| | <p align="center">System C-4</p> | | |
| <p>SERVICE:</p> <p>Surface Preparation:</p> <p>Primer Coat:</p> <p>First Coat:</p> <p>Second Coat:</p> <p>Third Coat:</p> <p>System Total:</p> <p>Volatile Organic Content:</p> | <p>Water-Retaining Concrete Structures, Interior and Exterior below water level-protection against acid producing bacteria and other elements.</p> <p>Per MANUFACTURER recommendations (sandblasting, pressure washing at 4,000 psi cementitious resurfacer, pressure wash film on build up. Heat with indirect heat at 200 degrees.</p> <p>Apply at 4 mils dry film thickness. [manufacture to confirm]</p> <p>Apply at 10 mils dry film thickness. [manufacture to confirm]</p> <p>[to be determined by manufacture]</p> <p>[to be determined by manufacture]</p> <p>Minimum 14 mils dry film thickness. [manufacture to determine the protective coating system thickness that is equivalent to the desired thickness of concrete.]</p> <p>None</p> | | |
| <p align="center"><u>COATING MANUFACTURER</u></p> | <p align="center"><u>PRODUCT DESIGNATION</u></p> | | |
| <p>PPG GML Coatings, LLC Euclid Chemical Co. Sika Corporation Tnemec Company, Inc. PPC Coatings</p> | <p>FIRST COAT Amerlock Sealer Green Monster Primer Duralkote 500 SikaGard 62 434 & 436 Series Prime coat</p> | <p>SECOND COAT Amercoat 100A (125 mils) Green Monster Extreme Same as first coat Same as first coat Same as first coat Intermediate coat</p> | <p>THIRD COAT Same as second coat (if needed) Same as second coat (if needed) Same as second coat (if needed) Same as second coat (if needed) Final Coat</p> |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | PROTECTIVE COATING SYSTEM | | |
| | System W-1 | | |
| <p><u>SERVICE:</u> Gypsum Board and Plaster, Mild Exposure, Interior Walls</p> <p>Surface Preparation: Clean and dry.</p> <p>First Coat: Acrylic Sealer. Apply at 1.5 to 2.0 mils dry film thickness.</p> <p>Second Coat: Water reducible acrylic coating with minimum 34% solids by volume, flat finish for walls and semi-gloss finish for doors and trim. Apply at 1.5 mils dry film thickness.</p> <p>Third Coat: Same as second coat</p> <p>System Total: Minimum 4.5 mils dry film thickness.</p> <p>Volatile Organic Content: Maximum 2.8 lbs/gal (340 g/l).</p> | | | |
| COATING MANUFACTURER | PRODUCT DESIGNATION | | |
| | FIRST COAT | SECOND COAT | THIRD COAT |
| PPGCarboline Devoe Tnemec Sherwin-Williams | PittTech Carbocrylic 120 Devflex 4020PF PVA Sealer 51-792 Prep Rite 200 Primer | PittTech Carbocrylic 3359 Devflex 4208QD H.B. Tneme-Tufcoat 113 Pro Industrial WB Catalyzed Epoxy | n/a Same as second coat Same as second coat Same as second coat Same as second coat |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | PROTECTIVE COATING SYSTEM | |
| | System W-2 | |
| <p><u>SERVICE:</u> Exterior Wood</p> <p>Surface Preparation: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.</p> <ol style="list-style-type: none"> a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried. b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, and casework. c. If transparent finish is required, back-prime with non-yellowing varnish. d. Back-prime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside. e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery. f. Surface must be prepared per paint MANUFACTURER's recommendations. <p>First Coat: Exterior Wood Primer: Factory-formulated alkyd wood primer for exterior application: 1. Applied at a dry film thickness of not less than 1.3 mils per coat.</p> <p>Second Coat: Exterior Finish Coats: 1. Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application. (2.3 mils per coat min)</p> <p>Third Coat: Same as Second Coat.</p> <p>System Total: 3.6 to 5.0 mils minimum, depending on primer and number of paint coats.</p> <p>Volatile Organic Content: Maximum 2.72 lbs/gal (326 g/l).</p> | | |
| COATING MANUFACTURER | PRODUCT DESIGNATION | |
| Sherwin-Williams | <p>FIRST COAT Wood Primer: A-100 Exterior Oil, Stain Blocking Primer (Y24W20).</p> | <p>SECOND COAT A-100 Exterior Latex Satin, (A82 Series)</p> |

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| South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406 | PROTECTIVE COATING SYSTEM | | |
| | System W-3 | | |
| <u>SERVICE:</u> Surface Preparation: First Coat: Second Coat: Third Coat: System Total: Volatile Organic Content: | Wood: Plywood Back Boards, Interior ASTM E84, clean and dry, free from grease, oil, and any other contamination. Apply per MANUFACTURERs recommendation Primer as required / approve by MANUFACTURER Intumescent Paint. Apply at 2.5 mills dry film thickness Same as second coat. Where indicated. Minimum 5.0 mils dry film thickness. Maximum 50 g/l (untinted) | | |
| COATING MANUFACTURER | PRODUCT DESIGNATION | | |
| Benjamin Moore & Co. International Fire Resistant Systems, Inc. PPG Industries, Inc. | FIRST COAT Fresh Start Alkyd Enamel Mfgr. Approved Primer Carbocrylic 120 Speed Hide 6-2 Interior Enamel Under Coater | SECOND COAT P59-01 Fire Free 88 Speed Hide 42-7 | THIRD COAT P59-01 N/A N/A |

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| <p align="center">South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406</p> | PROTECTIVE COATING SYSTEM | |
| | System A-1 | |
| <p><u>SERVICE:</u> Aluminum in contact with concrete or any other metal except galvanized steel</p> <p>Surface Preparation: Field: SSPC-SP1. Clean and dry</p> <p>First Coat: High solids polyamine or polyamide epoxy with minimum 67 % solids by volume. Brush apply to surfaces to be in contact at 4.0 mils DFT</p> <p>Second Coat: Same as first coat</p> <p>Third Coat: Not required</p> <p>System Total: Minimum 8 mils DFT</p> <p>Volatile Organic Content: Maximum 3.5 lbs/gal (425 g/l)</p> | | |
| COATING MANUFACTURER | PRODUCT DESIGNATION | |
| PPG Carboline ICI Devoe Tnemec Sherwin-Williams Wasser Corporation | FIRST COAT Amerlock 2/400 Carboguard 890 Devran 224HS Hi-Build Epoxoline II N69 Macropoxy 646 FC Epoxy MC-Prepbond 100 | SECOND COAT Same as first coat Same as first coat Same as first coat Same as first coat Same as first coat Same as first coat |

SECTION 11290 SLIDE GATES

PART 1 - GENERAL

1.01 SUMMARY:

- A. This SECTION includes self contained fabricated aluminum slide gates and accessories.
- B. Furnish the number and type of gates and operators as specified.
- C. Related Work Specified Elsewhere:
 - 1. DIVISION 1 – General Requirements
 - 2. SECTION 01300 - Submittals
 - 3. SECTION 09900 - Protective Coatings
 - 4. SECTION 11291 - Gate Actuators

1.02 REFERENCES:

- A. Applicable Standards: The latest revision of the following codes or standards shall apply to the WORK of this SECTION.
 - 1. American Water Works Association (AWWA):
 - a. ANSI/AWWA C513, Standard for Open-Channel, Fabricated-Metal Slide Gates and Open-Channel, Fabricated-Metal Weir Gates
 - b. ANSI/AWWA C540, Standard for Power-Actuating Devices for Valves and Slide Gates
 - c. The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C562 as modified herein.
 - d. The allowable leakage rate for the aluminum gates in this specification shall be in accordance with the allowable leakage listed in the latest revision of AWWA C562.
 - 2. American Society for Testing and Materials (ASTM):
 - a. A276 Standard Specification for Stainless Steel Bars and Shapes
 - b. A240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - c. A582 Standard Specification for Free-Machining Stainless Steel Bars
 - d. D4020 Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
 - e. D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
 - f. D2240 Standard Test Method for Rubber Property—Durometer Hardness
 - g. D395 Standard Test Methods for Rubber Property—Compression Set
 - h. F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - i. F594 Standard Specification for Stainless Steel Nuts
 - j. D2000 Standard Classification System for Rubber Products in Automotive Applications

1.03 SUBMITTALS:

- A. Submit as specified in SECTION 01300.

- B. Include, but not limited to, the following:
1. Catalog data and illustrations showing principal parts and materials
 2. Spare parts list
 3. Assembly, disassembly and repair instructions and procedures
 4. Detailed layout dimensions
 5. Protective coating system for non aluminum or stainless steel components
 6. Leakage testing procedures
 7. Installation, operation, and maintenance manuals
 8. Complete description of all materials including the material thickness of all structural components of the frame and slide.
 9. Installation drawings showing all details of construction, details required for installation, dimensions and anchor bolt locations.
 10. Maximum bending stress and deflection of the slide under the maximum design head.
 11. The location of the company headquarters and the location of the principle manufacturing facility. Provide the name of the company that manufactures the equipment if the supplier utilizes an outside source.

1.04 QUALITY ASSURANCE:

- A. MANUFACTURERs shall be experienced in the design and manufacture of equipment and accessories for a minimum period of five (5) years.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Shipment Preparation: Prepare equipment and materials for shipment in a manner to facilitate unloading and handling, and to protect against damage or unnecessary exposure in transit and storage. Include:
1. Crates or other suitable packaging materials
 2. Covers and other means to prevent corrosion, moisture damage, mechanical injury and accumulation of dirt in motors, electrical equipment and machinery
 3. Suitable rust-preventive compound on exposed machined surfaces and unpainted iron and steel
 4. Grease packing or oil lubrication in all bearings and similar items
- B. Marking:
1. Tag or mark each item of equipment or material as identified in the delivery schedule or on Submittals and include complete packing lists and bills of material with each shipment. Each piece of every item need not be marked separately provided that all pieces of each item are packed or bundled together and the packages or bundles are properly tagged and marked.
 2. Mark partial deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts, and to facilitate assembly.

1.06 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER's standard warranty, but for no less than one (1) year from the date of Substantial Completion, and as described in the Contract Documents.

- B. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Slide Gates:
1. Fontaine
 2. Golden Harvest
 3. Hydro Gate
 4. Rodney Hunt
 5. Whipps, Inc.
 6. DISTRICT approved equal

2.02 SLIDE GATES:

- A. Design Requirements:
1. Gate size, mounting type, seating and unseating heads, bottom seal elevations, pedestal or yoke elevations, and operator types shall be in accordance with Table 1:

Table 1 – Slide Gates

| | | Design Heads | | | | |
|--------------------|---|--------------|----------------|----------------------------------|---|-----------------------|
| Opening Size (WxH) | Mounting Type | Seating (ft) | Unseating (ft) | Bottom seal elevation (ft. NAVD) | Pedestal Floor or Yoke Elevation (ft. NAVD) | Operator Type |
| 8' x 8' | Upstream gate support face w/ bottom seal | 8 | 8 | 33.25 | Pedestal Floor at 49.25' | Electric motor driven |

2. Suitable for operation after periods of inactivity of a year or more.
3. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings.
4. Leakage shall not exceed 0.1 gpm/ft of wetted seal perimeter in seating head and unseating head conditions.
5. The gate shall utilize self-adjusting seals. Gates that utilize adjustable wedges or wedging devices are not acceptable.
6. All structural components of the frame and slide shall be fabricated of aluminum having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
7. All welds shall be performed by welders with AWS certification.
8. Finish: Mill finish on aluminum. Welds shall be cleaned to provide a uniform finish. All iron and steel components shall be properly prepared and shop coated with a primer.

- B. Frames:

1. The frame guides, invert member and yoke members shall be constructed of extruded aluminum shapes with a minimum thickness of 1/4-inch.
 - a. Frame design shall allow for embedded mounting or mounting directly to a wall with stainless steel anchor bolts and grout. Mounting style shall be as shown on the Contract Drawings.
 - b. The frame guides shall have a minimum weight of 4 lbs per foot of length for wall mounted and 3 lbs per foot for embedded or in-channel mounted.
 - c. The frame guides shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening slide gates or downward opening weir gates.
 - d. On self-contained gates, a yoke shall be provided across the top of the frame guides. The yoke shall be formed by two structural members affixed to the top of the guides to provide a one-piece rigid frame. The yoke shall be designed to allow removal of the slide.
 - e. A rigid extruded aluminum invert member shall be provided across the bottom of the opening. The invert member shall be of the flushbottom type on upward opening gates and shall have a minimum weight of 4 lbs per foot of length for wall mounted and 3 lbs per foot for embedded or in-channel mounted.
 - f. A rigid extruded aluminum top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
 - g. A rigid extruded aluminum member shall be provided across the invert of the opening on downward opening weir gates.

C. Slide:

1. The slide and reinforcing stiffeners shall be constructed of aluminum plate with a minimum thickness of 1/4-inch.
 - a. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head.
 - b. The portion of the slide that engages the frame shall have a minimum material thickness of 1/2-inch.
 - c. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Two vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.
 - d. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

D. Seals:

1. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification.
 - a. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
 - b. The seat/seals shall extend to accommodate the 1-1/2 x the height of the slide when the slide is in the fully closed or fully opened position.
 - c. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member of the frame or the bottom of the slide.
 - d. All downward opening weir gates shall be provided with UHMW polyethylene seat/seals across the invert member.
 - e. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.

- f. The seals shall be mounted so as not to obstruct the water way opening.
- g. Gates that utilize rubber “J” seals or “P” seals are not acceptable.

E. Slide Guides:

- 1. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
 - a. Stem guide brackets shall be constructed of aluminum or stainless steel with a minimum thickness of 1/4-inch and shall be outfitted with UHMW or bronze bushings.
 - b. Adjustable in two directions.

F. Stem, Stem Couplings, and Stem Guides:

- 1. Stems:
 - a. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. On rising stem gates, the threaded portion shall engage the operating nut in the manual operator or motor actuator. On non-rising stem gates, the threaded portion shall engage the nut on the slide.
 - i. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
 - ii. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.
 - iii. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Contract Drawings.
 - iv. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
 - v. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the crank or handwheel with a safety factor of 2, using the Euler column formula.
 - vi. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
 - vii. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
 - viii. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be bolted to the stems.
 - ix. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.

G. Anchor Bolts or Studs:

- 1. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
 - a. Quantity and location shall be determined by the gate manufacturer.
 - b. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.
 - c. Anchor bolts shall have a minimum diameter of 1/2-inch.

H. Materials:

| <u>Components</u> | <u>Materials</u> |
|--------------------------------------|------------------|
| Frame Guides, Yoke and Invert Member | 6061-T6 Aluminum |
| Slide and Stiffeners | 6061-T6 Aluminum |

| | |
|--|---|
| Stem | Stainless Steel, Type 304, ASTM A276 |
| Anchor Studs, Fasteners and Nuts | Stainless Steel, Type 316, ASTM A276 |
| Invert Seal (Upward Opening Gates Only) | Neoprene ASTM D-2000 or EPDM |
| Seat/Seal and Facing Ultra-High Molecular Weight | Polyethylene ASTM D4020 |
| Lift Nuts | Bronze ASTM B584 |
| Pedestal | 6061-T6 Aluminum or Stainless Steel, Type 304L, ASTM A-276 |
| Operator Housing | Cast aluminum or ductile iron |

2.03 GATE OPERATORS: Furnish a gate operator as specified in Table 1 in accordance with “A” or “B” below.

- A. Electric Motor Driven Operators shall meet requirements of SECTION 11291.
- B. Manual Operators:
 - 1. Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self contained gates or on the pedestal of non-self contained gates.
 - a. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb effort when the gate is in the closed position and experiencing the maximum operating head.
 - b. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
 - c. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
 - i. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - ii. Handwheel operators shall be equipped with roller bearings above and below the operating nut.
 - iii. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - iv. The handwheel shall be removable and shall have a minimum diameter of 15 inches.
 - d. Crank-operated gearboxes shall be fully enclosed and shall have a cast aluminum or ductile iron housing.
 - i. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
 - ii. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - iii. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
 - iv. Gears shall be steel with machined cut teeth designed for smooth operation.
 - v. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.
 - vi. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - vii. The crank shall be cast aluminum with a revolving nylon grip.

- viii. The crank shall be removable.
- e. All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.
 - i. Interconnecting shafting shall be constructed of aluminum or stainless steel.
 - ii. Flexible couplings shall be provided at each end of the interconnecting shaft. Couplings shall be stainless steel or non-metallic.
 - iii. One crank shall be provided to mount on the pinion shaft of one of the gearboxes.
- f. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non-gear operator, is located over 48-in above the operating floor. Chain wheels are not acceptable.
 - i. A removable aluminum or stainless steel cover shall be provided to enclose chain and sprockets.
 - ii. The extended operator system shall lower the centerline of the pinion shaft to 36-in above the operating floor.
 - iii. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60-in or less above the operating floor.
- g. Pedestals shall be constructed of aluminum or stainless steel.
 - i. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36-in above the operating floor.
 - ii. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of aluminum or stainless steel.
 - iii. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb effort on the crank or handwheel.
 - iv. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.
- h. Operators shall be equipped with fracture-resistant clear butyrate or lexan plastic stem covers.
 - i. The top of the stem cover shall be closed.
 - ii. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
 - iii. Stem covers shall be complete with indicator markings to indicate gate position.
- i. When shown on the Contract Drawings, provide 2 inch square nut with a non-rising stem.
 - i. The square nut shall be constructed of bronze.
 - ii. The floor box, if required, shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown.
 - iii. Provide one aluminum or stainless steel T-handle wrench for operation.

EXECUTION

2.04 INSTALLATION:

- A. Installation of the gates and appurtenances shall be done in a workmanlike manner. It shall be the responsibility of the CONTRACTOR to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The CONTRACTOR shall review the installation drawings and installation instruction prior to installing the gates.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The CONTRACTOR shall fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.
- E. Lubricate all bearings and gears before placing gates in operation.
- F. Provide MANUFACTURER's field services as specified in DIVISION 1.
- G. Perform equipment tests during and after start-up to determine if equipment is performing as specified. After installation, all gates shall be field tested in the presence of the ENGINEER and OWNER to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured, and shall not exceed the maximum operating effort specified above. Electric motor actuators shall function smoothly and without interruption. Each gate shall be water tested by the CONTRACTOR, at the discretion of the ENGINEER and OWNER, to confirm that leakage does not exceed the specified allowable leakage.

END OF SECTION

SECTION 11291 ELECTRIC ACTUATORS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This SECTION specifies the requirements for motorized slide gate operators.
- B. Related Work Specified Elsewhere:
 - A. DIVISION 1 – General Requirements
 - B. SECTION 09900 - Protective Coatings
 - C. SECTION 11290 - Slide Gates

1.02 REFERENCES:

- A. Applicable Standards:
 - A. American National Standards Institute (ANSI):
 - a. B1.1-Unified Screw Threads (UN and UNR Thread Form).
 - b. B36.10-Welded and Seamless Wrought Steel Pipe.
 - B. American Water Works Association (AWWA):
 - a. C513-05 – Open-Channel, Fabricated-Metal Slide Gates
 - b. C560-00 – Cast Iron Slide Gates
 - c. C561-04 – Fabricated Stainless Steel Slide Gates
 - d. C540 - Power-Actuating Devices for Valves and Sluice Gates.
 - C. American Society for Testing and Materials (ASTM):
 - a. A1 26 Class B - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. A1 67 - Stainless and Heat-Resisting Chromium-Nickel-Steel Plate, Sheet and Strip.
 - c. A1 76 Class B - Stainless and Heat-Resisting Steel Bars and Shapes.
 - d. A582 - Specification for Free-Machining Stainless and Heat-Resisting Steel Bars.
 - e. B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - f. B211 - Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
 - g. F-593 Alloy 304, S.S. Fasteners.
 - h. B-584 Bronze Seat Facings.
 - D. National Electric manufacturers Association (NEMA):
 - a. MG 1-10.40–Nameplate Marking for Medium Single-Phase and Polyphase Induction Motors.

1.03 SUBMITTALS:

- A. Include, but not limited to, the following:
 - A. Catalog data or illustrations showing principal parts and materials.
 - B. Catalog data or calculations, demonstrating torque output of the actuator in comparison to the torque required to operate the gate. The torque required shall be calculated by the gate MANUFACTURER, considering the stem and nut details and transmission efficiency, subject to approval by the DISTRICT.
 - C. Calculations for the motor horsepower and complete information on actuator motor.
 - D. Certification that all parts of the actuator are designed to withstand the required torque loads with a minimum factor of safety of five (5).
 - E. Spare parts list.
 - F. Assembly and disassembly or repair instructions.

- G. Detailed layout dimensions, including support frame and details of connection to the stem and nut assembly.
- H. Protective coating system.
- I. Testing procedures.
- J. Control schematic and wiring drawings.
- K. Detail of connection to the gate if existing stem needs replacement and new stem is supplied by the actuator supplier.
- L. MANUFACTURER's recommended sizing for feeder breaker, starter, overload relay, local disconnect switch, and power cables for actuator motor provided.

1.04 QUALITY ASSURANCE:

- A. MANUFACTURERs shall be experienced in the design and manufacture of actuators and accessories for a minimum period of ten (10) years.

1.05 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER's standard warranty, but for no less than one (1) year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 ACCEPTABLE GATE OPERATOR MANUFACTURERS:

- A. Only Limitorque actuators will be acceptable to the District for this project.

2.02 BASIC ACTUATOR:

- A. The electric gate actuator shall include the motor, actuator unit gearing, limit switch gearing, position limit switches, torque switches, declutch lever, and handwheel as a self-contained unit and shall connect to the gate via a threaded stem and stem nut.
- B. The actuator shall open and close the gate at a nominal speed of six (6) inches per minute.

2.03 ENCLOSURE:

- A. The gate actuator motor shall be totally enclosed. The actuator enclosure shall be NEMA 4 (watertight) for outdoor service. (Cast Iron or Cast Steel)
- B. Enclosure shall be factory painted with protective coating System S-3 as specified in SECTION 09900 or better.
- C. Electrical Controls: The actuator shall be furnished with power and control terminal strips, limit switches, torque switches, all housed in a control compartment meeting NEMA 4 (watertight). The enclosure shall have a bonded o-ring seal and a hinged cover. Cover bolting shall be captive stainless steel fasteners.
 - 1. The use of printed circuit boards as a substitute for interconnecting control wiring inside the operator is not acceptable.

2.04 OPEN-CLOSE SERVICE CONTROLS:

- A. The reversing contactor, pushbuttons, indicating lights, etc. shall be located within the control panel in the control building with separate push button controls located adjacent to the actuator. The CONTRACTOR shall coordinate the interconnecting control wiring between the operator furnished,

the control panel in the control building and push button controls located adjacent to the actuator whether furnished by the actuator supplier, electrical CONTRACTOR or general CONTRACTOR.

2.05 MOTOR:

- A. Motor shall be of sufficient rating to open or close the gate at the maximum design head conditions and through a complete gate duty cycle without exceeding its design parameters. Gate duty cycle is defined as the time required moving the gate from a full closed position to a full open position and back to a full closed position at nominal speed of six (6) inches per minute.
 - A. For gate duty cycle of 30 minutes or less, motor shall be totally enclosed non-ventilated (TENV) with minimum NEMA Class F insulation or totally enclosed fan cooled (TEFC) with minimum NEMA Class F insulation.
 - B. For gate duty cycle greater than 30 minutes, motor shall be totally enclosed fan cooled (TEFC) with minimum NEMA Class F insulation.
- B. The motor shall be an independent sub-assembly such that the power gearing shall not be an integral part of the motor assembly, to allow for motor or gear changes dictated by system operation requirements. The motor shall be equipped with internal thermal class B contacts and 120 volt AC heaters.
- C. The Contract Drawings shall determine the electric service for the gate motor. Single phase motor shall be 4-lead or 6-lead capacitor start, induction run type rated for 240 VAC use. Three phase motor shall be rated for 208 VAC use. The motor shall be capable of operating at plus or minus ten (10) percent of specified voltage. Motor bearings shall be of the anti-friction type and permanently lubricated. Motor frame shall be NEMA C-face mounting.
- D. The CONTRACTOR shall furnish feeder breaker, starter, overload relay, local disconnect switch, and power cables properly sized for the gate motor provided. The CONTRACTOR shall coordinate the selection of these items with the motor MANUFACTURER and shall submit recommendations to the DISTRICT for review.

2.06 POWER GEARING:

- A. The actuator shall be a multiple reduction unit with power gearing consisting of spur, helical, or bevel gears, and worm gearing. The spur, helical, or bevel gearing and worm shall be of hardened alloy steel, and the worm gear shall be alloy bronze. All gearing shall be accurately cut. Non-metallic, aluminum or cast gearing shall not be allowed. Anti-friction bearings shall be used throughout.

2.07 LUBRICATION:

- A. All rotating power train components shall be immersed in grease with provisions for inspection and re-lubrication without disassembly. Lubricants shall be suitable for ambient conditions of minus 20 degrees Fahrenheit to 150 degrees Fahrenheit. Adequate seals shall be provided on all shafting.

2.08 SELF-LOCKING FEATURE:

- A. Actuator gearing and/or stem threading shall be self-locking.

2.09 LOST MOTION DEVICE:

- A. The actuator shall have a built in device, incorporated in the power train and located between the worm gear and actuator drive sleeve, to permit load impact under dynamic efficiency conditions, to allow the motor to reach full speed before engaging the gate load.

2.10 MANUAL OPERATION:

- A. A metallic hand wheel shall be provided for manual operation with an arrow to indicate "open" rotation. The hand wheel shall not rotate during motor operation. An inoperative motor shall not prevent manual operation. When in the manual operating mode, the actuator will remain in this mode until the motor is energized, at which time the actuator will automatically return to electric operation. Movement from motor operation to hand wheel operation shall be accomplished by a positive

padlockable declutch lever which mechanically disengages the motor and related gearing. It shall be impossible for simultaneous manual and motor operation to occur. Friction type declutch mechanism are not acceptable.

2.11 STEM NUT:

- A. The gate actuator shall have a removable stem nut or drive bushing of high tensile bronze or other material compatible with the valve stem material.

2.12 POSITION LIMIT SWITCHES:

- A. Position limit switches and the associated gearing shall be integral part of the valve actuator. Limit switch gearing shall be of the intermittent type, made of bronze or stainless steel, grease lubricated, and totally enclosed to prevent dirt and foreign matter from entering the gear train. Switches shall be adjustable, allowing for trip points from fully open to fully closed positions of gate travel. They shall not be subject to breakage or slippage due to over-travel. Limit switch contacts shall be heavy duty, silver-plated with wiping action. The actuators shall have 2 NC and 2 NO switches for each end of travel position. Switch design shall permit visual verification of switch position without disassembly.

2.13 TORQUE SWITCH:

- A. Each gate actuator shall be equipped with a switch that will interrupt the control circuit in both the opening and closing directions when gate torque overload occurs or when gates require torque seating in the closed or open position. Two silver plated contacts shall be provided for each direction. One contact used for gate control and the other contact used for remote indication. The torque switch shall have graduated dials for both open and close directions of travel and each shall be independently adjustable, with a positive means to limit the adjustability so as not to exceed the actuator output torque capability. Switch design shall permit visible verification of switch position without disassembly.

2.14 SWITCH CONTACT RATINGS:

- A. The position limit switch and torque switch shall be rated 240 volts, five (5) amps continuous per NEMA standard ICS 2-125.

2.15 STEM LUBRICATION:

- A. Furnish automated stem oiler, Essex Brass model #377 with reservoir to lubricate the gate stem when motor is running in either the open or the close direction. The stem lubricator and/or drive nut shall be designed such that lubricating oil is distributed along the full length of the drive nut, ensuring that all threads from top to bottom, and regardless of the direction of stem travel, are lubricated. The lubricating system shall be capable of using 220 weight petroleum based lubricants.

2.16 POSITION INDICATOR:

- A. Local position indication shall be provided by a dial window indicator located on the limit switch compartment cover, and labeled in 10% increments from 0 to 100% open.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Comply with provisions of AWWA C560, C540 and as specified.
- B. Provide MANUFACTURER's field services as specified in DIVISION 1.
- C. Perform equipment tests during and after start-up to determine if equipment is performing as specified.
 - A. A MANUFACTURER's certified field service technician shall perform the start up of the gate operator. The technician shall accurately set the actuator's limit switches. The lower limit shall be set to interrupt the control circuit when the slide firmly makes contact with the bottom seal but before the torque switch opens. The upper limit shall be set to interrupt the control circuit

when the bottom of the gate clears the top seal. The technician shall set the torque switch values to levels recommended by the gate MANUFACTURER.

- D. Lubricate all bearings and gears before placing gates in operation.

END OF SECTION

SECTION 16050 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment and material for installation of the electrical hardware as described herein and as shown on the Drawings.
- B. The provisions of this Section apply to all sections in DIVISION 16, except as indicated otherwise.
- C. Concrete, excavation, backfill, and steel reinforcement required for encasement, installation, or construction of the WORK of the various sections of DIVISION 16 is included as a part of the WORK under the respective sections, including duct banks, manholes, handholes, equipment housekeeping pads, and light pole bases.
- D. For work at existing sites the CONTRACTOR shall be responsible for identifying available existing circuit breakers in lighting panels for the intended use as required by the Drawings. Costs for this WORK shall be included in the CONTRACTOR'S original bid amount.

1.02 REFERENCES: The following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.

- A. NEC (NFPA 70) National Electrical Code, 2014 edition
- B. NETA International Electrical Testing Association - Acceptance Testing Specifications, latest edition
- C. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum), latest edition
- D. Florida Building Code, 6th edition and the Standards referenced therein

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. The CONTRACTOR shall furnish submittals in accordance with SECTION 01300 - Contractor Submittals.
- B. The CONTRACTOR shall provide the following for shop drawing submittals:
 - 1. Complete material lists stating manufacturer and brand name of each item or class of material
 - 2. Front, side, rear elevations, and top views with dimensional data
 - 3. Location of conduit entrances and access plates
 - 4. Component data
 - 5. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers
 - 6. Method of anchoring, seismic requirements, weight
 - 7. Types of materials and finish
 - 8. Nameplates
 - 9. Temperature limitations, as applicable
 - 10. Voltage requirement, phase, and current, as applicable
 - 11. Front and rear access requirements

12. Test reports
 13. Grounding requirements
 14. Catalog cuts or photocopies of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material. Mark-out any model or part numbers of material on catalog data sheets that do not specifically apply to the project. Catalog data sheets shall be stamped to indicate the project name, applicable Section and paragraph, model number, and options.
- C. Shop Drawings shall be custom prepared. Drawings or data indicating "optional" or "as required" equipment are not acceptable. Options not proposed shall be crossed out or deleted from Shop Drawings.
 - D. Materials and Equipment Schedules: The CONTRACTOR shall deliver to the DISTRICT within 30 days of the commencement date in the Notice to Proceed, a complete list of all materials, equipment, apparatus, and fixtures proposed for use. The list shall include type, sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.
 - E. Owner's Manuals: Complete information in accordance with Section 01300.
 - F. Record Drawings: The CONTRACTOR shall show invert and top elevations and routing of all conduits in duct banks and concealed below-grade electrical installations. Buried electrical conduits shall be located by showing the horizontal distance to two fixed structures at the start of the conduit installation, the end of the conduit installation, and for every conduit change of direction. In addition, circuit schematic drawings and wiring drawings shall show all field changes. Layout drawings shall show all equipment location changes. Record drawings shall be prepared, be available to the DISTRICT, and be submitted according to Section 01300.
 - G. Where test reports are indicated, proof of design test reports for mass-produced equipment shall be submitted with the Shop Drawings, and factory performance test reports for custom-manufactured equipment shall be submitted and be approved prior to shipment. Field test reports shall be submitted for review prior to Substantial Completion.
- 1.05 QUALIFICATIONS: All electrical work shall be performed by personnel employed by an Electrical Contractor licensed in the State of Florida. Actual work shall be performed by Master and or Journeyman electricians or personnel under direct on-site supervision of a Master and or a Journeyman electrician. If the work is performed under the direct on-site supervision of a Journeyman electrician, he or she shall be certified in the county in which the work is performed or meet the reciprocity standards of Florida State Statue 489 part II. The credentials of the Electrical Contractor, Master and/or Journeyman electricians shall be supplied to the DISTRICT upon request.
- 1.06 RESPONSIBILITIES:
- A. The existing electrical service to the project site is to be reused per the design documents. The CONTRACTOR is responsible for maintaining the existing electrical service in good working condition.
 - B. Permits shall be obtained and inspection fees shall be paid according to General Conditions.
 - C. The CONTRACTOR shall be responsible for factory and field tests required by specifications in DIVISION 16 and by the DISTRICT and other authorities having jurisdiction. The CONTRACTOR shall furnish necessary testing equipment and pay costs of tests, including all replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of faulty installation.
- 1.07 TESTING: N/A

1.08 INSPECTION COORDINATION:

- A. The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Unless specifically noted as existing to be reused, the CONTRACTOR shall provide equipment and materials that shall be new, shall be listed by UL, or by an independent testing laboratory acceptable to the local code enforcement agency having jurisdiction, and shall bear the UL label or other certification where these requirements apply. Equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the WORK shall be products of the same manufacturer. Equipment and materials shall be of heavy duty industrial grade.
- B. Where the requirements of the specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements shall govern.
- C. On devices indicated to display dates, the year shall be displayed as 4 digits.

2.02 SIGNAGE:

- A. Electrical Equipment
 - 1. Each piece of electrical equipment shall be legibly marked to indicate its purpose unless the DISTRICT determines that its purpose is indicated by the location and arrangement.
- B. Warning Signs
 - 1. Over 50 Volts nominal, or more - Entrances to rooms and other guarded locations that contain live parts shall be marked with conspicuous signs prohibiting unqualified persons to enter.
 - 2. Outside branch circuits and feeders - for 600 volts nominal, or less - Warning signs shall be posted in plain view where unauthorized persons might come in contact with live parts.
- C. Isolating Switches - Isolating switches not interlocked with an approved circuit interrupting device shall be provided with a sign warning against opening them under load.

2.03 AREA DESIGNATIONS:

- A. General:
 - 1. Raceway system enclosures shall comply as mentioned herein and in SECTION 16110.
 - 2. Electric WORK specifically indicated in sections within any of the Specifications shall comply with those requirements.

| | |
|-------------|--------------------------------------|
| AREA | NEMA ENCLOSURE CLASSIFICATION |
|-------------|--------------------------------------|

| | 1 | 3R | 4X | 7 | 9 | 12 | Notes |
|------------------------|---|----|----|---|---|----|------------------------------------|
| Air Condition Space | √ | | | | | | |
| Non A/C Space Interior | | | | | | √ | Or as directed by project drawings |
| Outdoor Application | | | √ | | | | Or as directed by project drawings |

B. Materials Requirements

1. NEMA 4X enclosures shall be 316 stainless steel.
2. NEMA 7 enclosures shall be cast aluminum where used with aluminum conduit; cast iron when used with galvanized steel conduit.
3. NEMA 1, 3R, and 12 enclosures shall be steel coated with ANSI 61 grey paint. NEMA 4X, 7, and 9 enclosures shall not be painted.

2.04 MOUNTING HARDWARE:

A. Miscellaneous Hardware

1. Threaded rods for trapeze supports shall be continuous threaded, 3/8-inch diameter minimum. Utilize hot dipped galvanized steel for dry indoor non process areas and 316 stainless steel for “wet,” “damp,” or “corrosive” areas.
2. Strut for mounting of conduits and equipment shall be 316 stainless steel or hot dipped galvanized as specified on project drawings. Where contact with concrete or dissimilar metals may cause galvanic corrosion, suitable non-metallic insulators shall be utilized to prevent such corrosion.
3. Wall-mounted panels that weigh more than 500 pounds shall be provided and mounted with steel support pedestals. Transformers hung from 4-inch stud walls and weighing more than 300 pounds shall have auxiliary floor supports.

B. Bolts and Anchors

1. Standard Service (Non-Corrosive Application): Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel as indicated herein. 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.
 - a. Structural connections: ASTM A307, Grade A or B, hot-dip galvanized
 - b. Anchor Bolts: ASTM A307, Grade A or B, or ASTM A36, hot-dip galvanized
 - c. High strength bolts where indicated: ASTM A325
2. Corrosive Service: All bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated below.
 - a. All buried locations
 - b. All submerged locations
 - c. All locations subject to seasonal or occasional flooding
 - d. Inside hydraulic structures below the top of the structure
 - e. Inside buried vaults, manholes, and structures which do not drain through a gravity sewer or to a sump with a pump
 - f. All chemical handling areas
 - g. Inside trenches, containment walls, and curbed areas

DISTRICT. Lighting fixture locations shall be adjusted slightly as necessary prior to installation to avoid obstructions and to minimize shadows.

3. Wherever conduits and wiring for lighting and receptacles are not indicated, it shall be the CONTRACTOR'S responsibility to provide all lighting and receptacle-related conduits and wiring as required, based on the actual installed fixture layout and the circuit designations as indicated. Wiring shall be #12 AWG minimum, and conduits shall be 3/4-inch minimum (exposed) and 1-inch minimum (encased). Where circuits are combined in the same raceway, the CONTRACTOR shall derate conductor ampacities in accordance with NEC requirements.
- C. Workmanship: Materials and equipment shall be installed in strict accordance with printed recommendations of the manufacturer. Installation shall be accomplished by workers skilled in the work. Installation shall be coordinated in the field with other trades to avoid interference.
- D. Protection of Equipment and Materials: The CONTRACTOR shall fully protect materials and equipment against damage from any cause. Materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts shall be kept clean and dry. The CONTRACTOR shall replace or refinish damaged materials or equipment, including faceplates of panels and switchboard sections as part of the WORK.
- E. Incoming utility power equipment shall be provided in conformance with the utility's requirements.
- F. Installation of electrical equipment and materials shall comply with OSHA Safety and Health Standards (29 CFR 1910 and 29 FR 1926, as applicable), state building standards, and applicable local codes and regulations.

3.02 EQUIPMENT IDENTIFICATION:

- A. General: Equipment and devices shall be identified as follows:
 1. Nameplates shall be provided for all panelboards, control and instrumentation panels, starters, switches, and pushbutton stations. In addition to nameplates, control devices shall be equipped with standard collar-type legend plates.
 2. Control devices within enclosures shall be identified as indicated. Identification shall be similar to the subparagraph above.
 3. Toggle switches which control loads out of sight of switch and all multi-switch locations of more than 2 switches shall have inscribed finish plates clearly indicating the load.
 4. Where shown on the drawings, name tags shall be inscribed with the equipment name and tag number.
 5. The CONTRACTOR shall furnish typewritten circuit directories for panelboards; circuit directory shall accurately reflect the devices/equipment connected to each circuit breaker.

3.03 CLEANING:

- A. The CONTRACTOR shall thoroughly clean the electrical WORK before final acceptance. Exposed parts shall be thoroughly clean of cement, plaster, and other materials. Oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Touch-up paint shall be applied to scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum-cleaned.

END OF SECTION

SECTION 16120 WIRES AND CABLE

PART 1 - GENERAL

1.01 SCOPE:

- A. This SECTION includes furnishing and installing (including terminations) of all electrical wire, cable, and accessories.

1.02 REFERENCES: The following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied by this SECTION.

- A. NEC (NFPA 70) National Electrical Code, 2014 edition
- B. UL 83 - Thermoplastic Insulated Wires and Cables, latest edition
- C. NETA International Electrical Testing Association - Acceptance Testing Specifications, latest edition

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. The CONTRACTOR shall submit Shop Drawings in accordance with CONTRACTOR Submittals and SECTION 16050 – Basic Materials and Methods.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: N/A

1.07 TESTING:

- A. Cable Assembly and Testing: Cable assembly and testing shall comply with applicable requirements of NETA ATS Section 7.3.2. Factory test results shall be submitted in accordance with SECTION 01300 prior to shipment of cable. The following field tests shall be the minimum requirements:
 - 1. Power cable rated at 600 VAC shall be tested for insulation resistance between phases and from each phase to a ground using a megohmmeter.
 - 2. Field testing shall be done after cables are installed in the raceways.
 - 3. Field tests shall be performed by a certified test organization acceptable to the cable manufacturer. Test results shall be submitted to the DISTRICT for review and acceptance.
 - 4. Cables failing the tests shall be replaced with a new cable.
- B. Continuity Test: Control and instrumentation cables shall be tested for continuity, polarity, undesirable ground, and origination. Such tests shall be performed after installation and prior to placing cables in service.

1.08 INSPECTION COORDINATION:

- A. The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS, and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - MATERIALS

2.01 GENERAL:

- A. Conductors, include grounding conductors, shall be stranded copper. Aluminum conductor wire and cable will not be permitted. Insulation shall bear UL label, the manufacturer's trademark, and identify the type, voltage, and conductor size. All conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment such as motors and controllers shall conform to the requirements of Article 310 of the National Electric Code, latest edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400, and fixture wires shall conform to Article 402. Wiring shall have wire markers at each end.

2.02 LOW VOLTAGE WIRE AND CABLE:

- A. Power and Lighting Wire
 - 1. Wire rated for 600 volts in duct or conduit for all power and lighting circuits shall be Class B Type THHN or THWN, polyvinyl chloride rated at 90°C in dry locations, 75°C in wet locations, meeting the requirements of UL 83.
 - 2. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
 - 3. Conductors for branch circuits as defined in Article 100 of the NEC shall be sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
- B. Control Wire
 - 1. Control wire in duct or conduit shall be the same type as power and lighting wire indicated above.
 - 2. Interconnecting control wiring installed in conduit to or between field devices (field wiring) shall be sized in accordance with NEC Article 310.15, Table 310.16 and shall not be smaller than No.14 AWG (minimum), unless otherwise indicated on project drawings
 - 3. Internal wiring installed within a control panel and cabinets shall be sized in accordance with NFPA 79, Table 12.5.1; and shall not be smaller than No. 18 AWG, unless otherwise indicated on project drawings.
 - 4. Internal control wires within control panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.
- C. Instrumentation Cable
 - 1. Instrumentation cable shall be rated at 600 volts.

2. Individual conductors shall be No. 16 AWG stranded, tinned copper. Insulation shall be color coded polyethylene: black-red for two-conductor cable and black-red-white for three-conductor cable.
3. Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a No. 16 AWG stranded tinned copper drain wire, and a PVC outer jacket with a nominal thickness of 0.048-inches.

2.03 CONNECTORS:

A. General Requirements:

1. Cable connectors shall be designed and sized for specific cable being connected.
2. Solderless, pressure-type connectors shall be constructed of non-corrodible tin-plated copper.
3. All connectors shall have a current-carrying capacity equal to or greater than the cable being connected.
4. Application tooling for compression type connectors shall contain die or piston stops to prevent over-crimping and cycling or pressure relief to prevent under-crimping. Dies of all application tooling shall provide wire size coding for quality control verification. All tooling shall be manufactured by the connector manufacturer.
5. General purpose insulating tape shall be high temperature (105°C) tape, with a dielectric strength of 1,150 V/mil of polyvinyl material.

B. Mechanical Pressure Connectors:

1. Connectors shall be threaded split bolt type of high strength copper alloy.
2. Pressure type, twist-on connectors will not be acceptable.
3. Barrel shall have funnel entry, and vinyl insulation.

C. Power Lugs (10 AWG and Smaller) 600V and Below:

1. Pre-insulated ring tongue type
2. Manufactured from high-strength copper alloy

D. Power Lugs (Sizes 8-4 AWG) 600V and Below:

1. Non-insulated ring-tongue type
2. Ring tongue sized to match terminal stud size
3. Brazed barrel seam
4. Sight hole to verify proper cable insertion
5. Application tooling designed to crimp the wire barrel (conductor grip) with a one-step crimp

E. Control, Instrument and Specialty Cable Connectors:

1. Tin-plated copper
2. Vinyl or nylon pre-insulated ring-tongue type (Spade lugs will not be permitted.)
3. Sized to match terminal stud size
4. Have insulation grip sleeve to firmly hold to cable insulation
5. Insulation grip sleeve shall be funneled to facilitate wire insertion and prevent turned-back strands.

6. Application tooling designed to crimp the wire barrel (conductor grip) and the insulation grip sleeve with a one-step crimp.

2.04 CABLE IDENTIFICATION SLEEVES:

- A. Refer to SECTION 16050 for appropriate conductor identification material.

PART 3 - EXECUTION

3.01 GENERAL:

- A. The CONTRACTOR shall provide and terminate all power, control, and instrumentation conductors except where indicated.

3.02 INSTALLATION:

- A. Conductors shall not be pulled into raceway until raceway has been cleared of moisture and debris.
- B. Pulling tensions on raceway cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL approved.
- C. Instrumentation wire shall not be run in the same raceway with power and control wiring except where specifically indicated.
- D. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.

3.03 SPLICES AND TERMINATIONS:

A. General

1. Wire taps and splices shall be properly taped and insulated according to their respective classes.
2. In general, there shall be no cable splices in underground manholes or pullboxes. If splices are necessary, the cables shall be brought aboveground and terminated in a NEMA 4X, stainless steel terminal or splice cabinet that is stand mounted on a concrete pad. Splices in underground manholes and pullboxes may be made only with the approval of the DISTRICT **and shall utilize outdoor mechanical or compression type splice connectors meeting UL486D and UL50 requirements.**
3. Stranded conductors shall be terminated directly on equipment box lugs making sure that all conductor strands are confined within lug. Use compression lugs where equipment box lugs have not been provided.
4. Surplus control and instrumentation wire shall be properly taped and terminated as spares.

B. Control Wire and Cable

1. Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment.
2. In junction boxes, motor control centers, and control panels, control wire and spare wire shall be terminated to terminal strips.

C. Instrumentation Wire and Cable

1. Shielded instrumentation cables shall be grounded at one end only, preferably the receiving end on a 4-20 mA system.

2. Two and three conductor shielded cables installed in conduit runs which exceed available standard cable lengths may be spliced in pullboxes. Such cable runs shall have only one splice per conductor. Splices, where approved by the DISTRICT, shall be made on terminal blocks.
- D. Power Wire and Cable
1. All 120/240-volt branch circuit conductors may be spliced in suitable boxes or conduit bodies at locations determined by the CONTRACTOR.
 2. Splices to motor leads in motor terminal boxes shall be wrapped with mastic material to form a mold and then shall be taped with a minimum of two layers of varnished cambric tape overtaped with a minimum of two layers of high temperature tape.

3.04 CABLE IDENTIFICATION:

- A. General: Wires and cables shall be identified for proper control of circuits and equipment and to reduce maintenance effort.
- B. Identification Numbers: The CONTRACTOR shall assign to each control and instrumentation wire and cable a unique identification number. Numbers shall be assigned to all conductors having common terminals and shall be shown on "as built" drawings. Identification numbers shall appear within 3-inches of conductor terminals. "Control Conductor" shall be defined as any conductor used for alarm, control, annunciation, or signal purposes.
1. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. It is expected that the cable number shall form a part of the individual wire number. Individual control conductors and instrumentation cable shall be identified at pull points as described above. The instrumentation cable numbers shall incorporate the loop numbers assigned in the Contract Documents.
 2. All 120/240-volt system conductors shall be color coded as follows: Line 1 - Black, Line 2 - Red, and Neutral - White. Color coding tape shall be used where colored insulation is not available. Branch circuit switched conductors shall be yellow. Insulated ground wire shall be green. Color coding and phasing shall be consistent throughout the Site, but bus bars at panelboards shall be connected Phase A-B left to right, facing connecting lugs.
 3. Spare conductors shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.
 4. Terminal strips shall be identified by computer printable, cloth, self-sticking marker strips attached under the terminal strip.

END OF SECTION

SECTION 16140 WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE:

The Work of this Section shall consist of furnishing all labor, materials, and equipment necessary for installation of wiring devices and plates as shown on the Drawings and specified herein.

1.02 REFERENCES: The following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.

- A. NEC (NFPA 70) National Electrical Code, 2014 edition
- B. NETA International Electrical Testing Association - Acceptance Testing Specifications, latest edition
- C. NEMA 250 - Enclosure for Electrical Equipment (1,000 Volts Maximum), latest edition
- D. Florida Building Code, 6th Edition and the Standards referenced therein
- E. UL 1449 Standard for Transient Voltage Surge Suppressors, latest edition
- F. UL 498 Standard for Safety Attachment Plugs and Receptacles, latest edition

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Furnish submittals in accordance with Contractor Submittals.
- B. Shop Drawings
 - 1. Complete catalog cuts of switches, receptacles, enclosures, covers, and appurtenances, marked to clearly identify proposed materials
 - 2. Documentation showing that proposed materials comply with the requirements of NEC and U.L.

1.05 QUALIFICATIONS:

- 1. Submit documentation of the manufacturer's qualifications.

1.06 RESPONSIBILITIES:

- A. The Requirements of SECTION 16050 Basic Materials and Methods apply to this section.
- B. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.07 TESTING:

- A. Provide checkout, field, and functional testing of wiring devices in accordance with SECTION 16050.
- B. Test each receptacle for polarity and ground integrity with a standard receptacle tester.
- C. Test GFCI receptacle for correct tripping operation with suitable tester.

1.08 INSPECTIONS COORDINATION:

The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 RECEPTACLES:

- A. Industrial Grade: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publications and UL Listings. Receptacles shall be rated for 125 VAC, 20 amperes shall be polarized 3 wire type for use with 3 wire cord with grounded lead and 1 designated stud shall be permanently grounded to the conduit system (NEMA 5-20R). Receptacles shall also be fire-resistant, non-absorptive, with nylon top (face) and bodies and bases with metal plaster ears (integral with the supporting member). They shall be single or duplex as shown or noted on drawings, and ivory color unless otherwise noted, with triple wipe or equivalent brass alloy power contacts for each prong. Approved manufacturers are Hubbell, Cooper, Pass & Seymour, or Leviton, or DISTRICT approved equal.
- B. Grounding Type: All receptacles shall be grounding type with a green-colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper in accordance with NEC, Article 250. .
 - 1. Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.
- C. GFCI: Ground-fault circuit interrupting receptacles (GFCI's) shall be installed at the locations indicated and as required by the NEC. GFCI's shall be duplex, Industrial or Hospital grade, tripping at 5 mA. Ratings shall be 125 V, 20 amperes, NEMA WD-1, Configuration 5-20R, capable of interrupting 5,000 amperes without damage. Feed-through type GFCI's serving standard receptacles will not be permitted.

2.02 PLUG CAPS & CORDS:

Provide and install a matching plug cap and properly-sized cord for equipment items noted on the drawings as by Electrical Contractor. No plug caps are required for duplex receptacle.

2.03 DEVICE PLATES:

- A. General: Provide device plates for each switch, receptacle, signal and telephone outlet, and special purpose outlet. Do not use sectional gang plates for multi-gang boxes. Plates shall be of commercial grade nylon.

PART 3 - EXECUTION

3.01 GENERAL: Perform work in accordance with the National Electrical Code.

3.02 CONNECTION:

- A. Rigidly attach wiring devices in accordance with National Electrical Code, and as indicated, avoiding interference with other equipment.
- B. Securely fasten nameplates using screws, bolts, or rivets centered under or on the device, unless otherwise indicated.

3.03 GROUNDING:

- A. Ground all devices, including switches and receptacles, in accordance with NEC, ART 250, and SECTION 16450 Grounding.
- B. Ground switches and associated metal plates through switch mounting yoke, outlet box, and raceway system.
- C. Ground flush receptacles and their metal plates through positive ground connections to outlet box and grounding system. Maintain ground to each receptacle by spring-loaded grounding contact to mounting screw or by grounding jumper, each making positive connection to outlet box and grounding system at all times.

END OF SECTION

SECTION 16160 PANELBOARDS AND GENERAL PURPOSE DRY TYPE TRANSFORMER

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONTRACTOR shall provide panelboards and general purpose dry-type transformers, complete and operable, in accordance with the Contract Documents.
- B. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.02 REFERENCES: The following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.

- A. NEC (NFPA 70) National Electrical Code, 2014 edition
- B. NEMA 250 Enclosure for Electrical Equipment (1,000 Volts Maximum), latest edition
- C. UL 50 - Standard for Safety for Enclosures for Electrical Equipment, latest edition
- D. UL 67 - Panelboards, latest edition
- E. ASTM D635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position, latest edition
- F. NETA International Electrical Testing Association - Acceptance Testing Specifications, latest edition

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. General: Submittals shall be in accordance with Contractor Submittals and SECTION 16050 Basic Materials and Methods.
- B. Shop Drawings
 - 1. Panelboards
 - a. Breaker layout drawings with dimensions and nameplate designations
 - b. Component list
 - c. Drawings of conduit entry/exit locations
 - d. Assembly ratings including:
 - i. Short circuit rating
 - ii. Voltage
 - iii. Continuous current
 - e. Cable terminal sizes
 - f. Descriptive bulletins
 - g. Product sheets
 - h. Installation information

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: N/A

1.07 TESTING: N/A

1.08 INSPECTION COORDINATION:

The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Panelboards:

- 1. Panelboards shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 - Safety Enclosures for Electrical Equipment and UL 67 - Panelboards. Panelboards used for service equipment shall be UL labeled for such use. Lighting panelboards shall be rated for 120/208-volt, 3-phase operation or 120/240-volt for single phase operation as indicated. Power panelboards shall be rated for 480 volts, 3-phase, 3-wire operation.
- 2. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.

2.02 PANELBOARDS:

A. Ratings:

- 1. Panelboards rated 240 VAC or less shall have short circuit ratings not less than 10,000 amperes RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.
- 2. Panelboards shall be labeled with a UL short circuit rating. Series ratings are not acceptable.

B. Construction:

- 1. All lighting and power distribution panels shall have copper bus bars.
- 2. Breakers shall be one or two pole as indicated, with ampere trip ratings as required by the equipment. Breakers shall be quick-make and quick-break, inverse time trip characteristics, to trip free on overload or short circuit, and to indicate trip condition by the handle position.
- 3. The panels shall have hinged doors with combination catch and latch. The front panels shall be so arranged that when the plates are removed, the gutters, terminals and wiring will be exposed and accessible. The doors shall have inner doors within the plates to have only the breaker operating mechanism exposed when they are opened. Live conductors and terminals shall be concealed behind the plates.
- 4. All panelboards shall be rated for the intended voltage.

5. All circuit breakers shall be interchangeable and capable of being operated in any position as well as being removable from the front of the panelboard without disturbing adjacent units.
6. Lighting and power distribution panels shall be constructed in accordance with SECTION 16050. Panels shall have the necessary barriers, supports, and liberal wiring gutters. Trim screws shall be stainless steel. All panelboard parts of metal other than copper, aluminum, or stainless steel shall be cadmium plated.
7. Panelboards shall be UL listed except for special enclosures which are not available with UL listing.
8. Panelboards shall be suitable for use as service entrance as indicated or as otherwise required by the NEC.

PART 3 - EXECUTION

3.01 GENERAL:

- A. All WORK of this Section shall be installed as indicated in SECTION 16050.

3.02 EQUIPMENT:

- A. The CONTRACTOR shall install the specified panelboards at locations indicated on the drawings.
- B. The CONTRACTOR shall surface mount panelboards on wall, as indicated on project drawings, at an elevation convenient for operation and as required in the latest NEC.
- C. Install circuit directory in panelboard. The directory shall be typed, clearly indicating the serving load on each circuit breaker line.

END OF SECTION

SECTION 16450 GROUNDING

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONTRACTOR shall provide the electrical grounding system, complete and operable, in accordance with the Contract Documents. Including but not limited to the building grounding grid, the grounding rod system and ground riser extension to electrical equipment.
- B. The requirements of SECTION 16050 - Basic Materials and Methods, General apply to this SECTION.

1.02 REFERENCES: The following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.

- A. NEC Article 250 – Grounding, 2014 edition
- B. UL 467 - Standard for Safety Grounding and Bonding Equipment, latest edition
- C. IEEE 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding, latest edition
- D. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, latest edition
- E. AWWA C210 - Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines, latest edition
- F. NETA (International Acceptance Testing Specifications), latest edition

1.03 DEFINITIONS:

- A. Low Voltage Grounded System (600V or less): A low voltage grounded system is a system where the local power supply is a transformer with the transformer secondary grounded.
 - 1. The first disconnecting means on the load side of this transformer shall provide the point where the neutral conductor is grounded.
 - 2. The neutral shall be connected to the Equipment Grounding Circuit Conductor only at one point which is within the enclosure of the disconnecting means.
 - 3. The Grounding Electrode Conductor or the Equipment Grounding Circuit Conductor shall not be used as the neutral.

1.04 SUBMITTALS:

- A. Furnish submittals in accordance with CONTRACTOR Submittals and SECTION 16050.
- B. Product Data: Manufacturer's product information for connections, clamps, grounding rods and grounding system components, showing compliance with the requirements of this SECTION.
- C. “As-built” Drawings: Provide the DISTRICT with “as-built” drawings of actual grounding system installation. The “as-built” drawings of the grounding system shall be signed and sealed by a State of Florida licensed land surveyor.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall not conceal or cover any ground connections until the DISTRICT has established that every grounding connection conforms to the Contract Documents and has given the CONTRACTOR written confirmation.

1.07 TESTING:

- A. Measure and test the ground impedance in accordance with IEEE Standard 81 after installation but before connecting the electrode to the remaining grounding system. Verify all ground potentials on plan drawings and submit to the DISTRICT for final approval.
- B. Test the grounding system per NETA ATS section 7.13 and called for in SECTION 16950 - Field Testing.
- C. INSPECTIONS COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.08 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS, and PRODUCTS specified in this SECTION against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Components of the grounding electrode system shall be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding Equipment, and shall conform to the applicable requirements of National Electrical Code Article 250 and local codes.

2.02 GROUNDING ELECTRODE SYSTEM:

- A. Grounding loop conductors shall be bare annealed copper conductors suitable for direct burial. Conductors shall be #2/0 AWG unless indicated otherwise.
- B. Ground Rods
 - 1. Unless indicated otherwise, the ground rod shall be a minimum of 3/4-inch in diameter, 20-feet long with pointed end to facilitate driving, and have a uniform covering of electrolytic copper metallically bonded to a rigid steel core. The copper to steel bond shall be corrosion resistant. The rod length shall be clearly stamped near the top of the rod.
 - 2. Conform to ANSI/UL 467.
 - 3. Sectional type joined by threaded copper alloy couplings.
- C. Buried cable-to-cable and cable-to-ground rod connections shall be made using exothermic welds or compression connectors suitable for direct burial.
- D. Exposed grounding connectors shall be of the compression type (connector to cable), made of high copper alloy, and be manufactured specifically for the particular grounding application.
- E. Grounding clamps shall be used to bond each separately derived system to the grounding electrode conductors.
- F. Equipment Grounding Circuit Conductors
 - 1. These conductors shall be the same type and insulation as the load circuit conductors. The minimum size shall be in accordance with the NEC-Article 250, unless indicated otherwise.
 - 2. Present in all raceways. The conduit system is not an allowable equipment ground.
 - 3. Cable to equipment ground lugs shall be compression type, bolted to the equipment with silicon bronze bolts and lock washers.

2.03 COATINGS:

- A. Coal Tar:

1. All underground grounding connections shall be coated with coal tar as specified herein.
2. Coating shall be of Polyamide Epoxy-Coal Tar with high build corrosion resistance. Resulting coat shall conform to the performance requirements of AWWA C 210.

PART 3 - EXECUTION:

3.01 WIRE, CABLE AND RACEWAY GROUNDING:

- A. Provide a separate grounding conductor, securely grounded in each raceway independent of raceway material as well as in each raceway with parallel feeder run.
- B. Size shall be as given on the conduit schedule and in accordance with the NEC-Article 250.
- C. Provide the duct bank ground system indicated, including, trenching, splices, ground rods, and connections to equipment and structures.
- D. Grounding Wires and Cables:
 1. Install using as few joints as possible.
 2. Protect against abrasion by several wrappings of rubber tape at all points where cable leaves concrete in exposed areas.
 3. Suitably protect cable against damage during construction.
 4. Replace or suitably repair cable if damaged by anyone before final acceptance.

3.02 GROUNDING BOXES, MOTORS AND ELECTRICAL EQUIPMENT:

- A. Provide a separate grounding conductor for each motor and connect at motor box. Do not use bolts securing motor box to frame or cover for grounding connectors.
- B. Provide a grounding type bushing for secondary feeder and branch circuit conduits which originate from the secondary section of each MCC section, switchboard, or panelboard.
- C. Individually bond these raceways to the ground bus in the secondary section.
- D. Provide solid copper green insulated wire as grounding jumper from the ground screw to a box grounding screw and, for grounding type devices, to equipment grounding conductor.
- E. Interconnect the secondary switchgear neutral bus to the ground bus in the secondary switchgear compartment only at service entrance point or after a transformer.

3.03 GROUNDING SYSTEMS:

- A. Embedded Ground Connectors
 1. The connection shall be made in accordance with the manufacturer's instructions.
 2. Lay in bottom of trench or in other excavations at least 18 inches below finished grade.
 3. Maintain clearance of at least 12 inches from all underground metal piping or structures, except where connections thereto are specifically indicated.
 4. Duct Bank Ground: A grounding conductor shall be embedded in every duct bank as indicated.
- B. Ground Ring
 1. Furnish trenching and materials necessary to install the ground ring as indicated.
 2. Bonding conductor shall be in direct contact with the earth and be of the size indicated.
 3. Minimum burial depth **30-inches** or as indicated on the Drawings, whichever is greater.
 4. Re-compact disturbed soils to original density in 6-inch layers.
- C. Ground Rods
 1. Ground rods forming an individual ground array shall be equal in length.
 2. The CONTRACTOR shall install rods as indicated by driving and not by drilling or jetting.
 3. The CONTRACTOR shall drive rods into unexcavated portion of the earth where possible.

4. In excavated areas, the CONTRACTOR shall drive grounding rods after compaction and backfill is completed.
5. The CONTRACTOR shall drive to a depth such that top of rods will be approximately **30** inches below final grade, or subgrade, and connect main grid ground cable thereto.

3.04 SHIELD GROUNDING:

- A. Shielded instrumentation cable shall have its shield grounded at one end only unless Shop Drawings indicate the shield will be grounded at both ends.
- B. The grounding point shall be at the control panel or otherwise at the receiving end of the signal carried by the cable.
- C. Termination of shield drain wire shall be on its own terminal screw.
- D. All terminal screws shall be jumpered together using manufactured terminal block jumpers.
- E. Connection to the ground bus shall be via a green No. 12 conductor to the main ground bus for the panel.

END OF SECTION

SECTION 16910 STRUCTURE REMOTE TERMINAL UNIT (RTU)

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS:

- A. This section specifies requirements for a remote terminal unit, RTU, used for control and monitoring of a gated structure. The RTU panel is modular in design and includes power supply, battery, processor, I/O cards, relays, surge arrestors, etc. as shown on the plans and as specified herein.
- B. CONTRACTOR shall be responsible for functionally testing the RTU cabinet as detailed herein utilizing the Motorola Systems Tools Suite program.

1.02 REFERENCES: The following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.

- A. National Electric Manufacturers Association (NEMA):
 - 1. NEMA 250 – Enclosures for Electrical Equipment, latest edition
 - 2. NEMA ICS 2 – Industrial Control Devices, Controllers, and Assemblies, latest edition
 - 3. NEMA ICS 3 – Industrial Systems, latest edition
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 – National Electrical Code, 2014 edition
- C. Underwriters Laboratories (UL), latest editions

1.03 SUBMITTALS REQUIRING DISTRICT APPROVAL:

- A. Manufacturer's standard catalog data, including a description and depiction of all control devices and instruments in sufficient detail to demonstrate complete specification compliance. If standard catalog data does not contain sufficient detail to verify compliance, then the CONTRACTOR shall submit supplementary documentation to verify compliance.
- B. Layout and shop drawings, including the following:
 - 1. RTU cabinet layout, including fully dimensioned and detailed external views and internal layout
 - 2. Electrical schematics, including but not limited to block diagrams, ladder diagrams, DC panel wiring and instrument wiring
 - 3. Layout of relays, breakers, switches and instrumentation provided, and applicable single line and wiring diagrams
- C. Operating manuals

1.04 FABRICATOR QUALIFICATIONS:

- A. Panel fabrication shall be by a manufacturer or a particular division of a manufacturing firm specializing in control panel construction.
- B. Fabricator shall have a U.L. certified shop and all panels shall be built according to U.L. 508.

1.05 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard

warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.

- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 REMOTE TERMINAL UNIT (RTU) CABINET:

- A. The Remote Terminal Unit (RTU) as detailed on the Plans and as described herein shall consist of devices and instrumentation to control the operation and to provide control and monitoring of a gated structure.
- B. The CONTRACTOR shall construct the Remote Terminal Unit as shown and as detailed on the Plans.
 - 1. The CONTRACTOR must submit for DISTRICT approval any deviation from the specified components before fabricating the panel.
- C. The Project I/O List shown on the Plans summarizes the digital inputs, digital outputs, and analog inputs for the RTU.
 - 1. The CONTRACTOR must submit for DISTRICT approval any deviation from the specified Project I/O List.

2.02 **REMOTE TERMINAL UNIT PROGRAMMING:** The CONTRACTOR shall be responsible to furnish and install the Motorola Systems Tools Suite (STS) program into the new RTU to functionally test each input and output as detailed in Section 3.02 FIELD TESTS within this Specification. Following the successful initial functional test of the RTU's I/O, the CONTRACTOR shall schedule with the DISTRICT a second functional test witnessed by the DISTRICT.

PART 3 - EXECUTION:

3.01 **GENERAL:** The CONTRACTOR shall furnish and install all cable, wiring, and conduit as required and as specified in the Plans and Specifications to power, control, and monitor the RTU Panel installation.

3.02 **FIELD TESTS:** Upon the completion of the RTU installation, the CONTRACTOR shall procure the services of an authorized RTU Manufacturer's Representative to functionally test the RTU cabinet.

- A. As a minimum, RTU testing shall include the following:
 - 1. Using Motorola's STS program, simulate each discrete input and each analog input from the signal device back to the RTU cabinet. With the RTU energized, show to the DISTRICT that the RTU's processor received the input signal.
 - 2. Using Motorola's STS program, simulate each discrete output from the RTU to the end device.
- B. The RTU Manufacturer's Representative shall be knowledgeable on all aspects of the RTU system, including the checkout, startup, programming, and integration of the system. The CONTRACTOR agrees to supply the services of a qualified Manufacturer's Representative and shall submit his qualifications for DISTRICT review two weeks prior to his arrival on site.
- C. In addition to the time required by the RTU Manufacturer's Representative for the specified checkout and startup of the RTU installation, furnish his services for a minimum of two site visits with a total of 20 on-site manhours to assist the DISTRICT with the programming and the integration of the RTU system and/or conducting on-site training. The DISTRICT'S use of the RTU Manufacturer's Representative shall be at the discretion of the DISTRICT upon 48 hours prior notification to the CONTRACTOR. The Manufacturer's Representative shall be furnished at no additional cost to the DISTRICT, including travel time, plane ticket costs, room and board, overtime premium, etc.

END OF SECTION

SECTION 16950 FIELD TESTING

PART 1 - GENERAL

1.01 SCOPE:

- A. This Section specifies the work necessary to test, commission, and demonstrate that the electrical work satisfies the criteria of these specifications and functions as required by the Contract Documents.
- B. The work of this Section includes furnishing the labor, equipment, and power required to support the testing specified in other divisions of these Specifications. This scope may require the CONTRACTOR to activate circuits, shutdown circuits, and run equipment, make electrical measurements, replace blown fuses, install temporary jumpers, etc.
- C. The requirements of SECTION 16050 Basic Materials and Methods, apply to the WORK of this Section.

1.02 REFERENCES: The following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.

- A. (ASTM) American Society for Testing and Materials, latest edition
- B. (ICEA) Insulated Cable Engineers Association, latest edition
- C. NEC (NFPA 70) National Electrical Code, 2014 edition
- D. (NEMA) National Electrical Manufacturers Association, latest edition
- E. (NETA) International Electrical Testing Association - Acceptance Testing Specifications, latest edition

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Five (5) bound copies of the certified test reports shall be submitted by the independent testing firm to the CONTRACTOR upon completion of the project. The final report shall be signed and shall include the following information:
 - 1. Summary of the project
 - 2. Description of equipment tested
 - 3. Visual Inspection report
 - 4. Description of tests
 - 5. Test data
 - 6. Analysis and recommendations
 - 7. Appendix including appropriate test forms
 - 8. Identification of test equipment used and calibration dates

1.05 TESTING:

- A. The following test requirements supplement test and acceptance criteria that may be stated elsewhere.
 - 1. Lighting: Switching, including remote control, if indicated. Verify circuitry is in accordance with panel schedules. Switches rated less than 600V shall be tested in accordance with NETA

- ATS Section 7.5.1.1. Switches shall be toggled, back and or side contacts tested for correct wiring, any special features verified.
2. Meters shall be tested as per NETA ATS Section 7.11.
 3. Instrument transformers shall be tested as per NETA ATS Section 7.10.
 4. Demonstrate mechanical and/or electrical interlocking by attempting to subvert the intended sequence.
 5. Activate ground fault tripping by operating test features provided with ground current protective systems and by injecting a known and reasonable current in the ground current sensor circuit. Testing procedures outlined in NETA ATS Section 7.14 - Ground Fault Protection Systems - shall also be used.
 6. Surge arrestors rated less than 600V shall be tested as per NETA ATS Section 7.19.1
 7. Cable Testing: Low voltage 600-volt maximum cable shall be tested for insulation resistance. Testing shall be done after the equipment is terminated. Inspection and test procedures, as outlined in NETA ATS Section 7.3.2 - Cables, shall be followed. Test results, stating equipment used and time of test shall be submitted for review 30 days prior to plant operation and any system testing. Equipment which may be damaged during this test shall be disconnected. Perform tests with all other equipment connected to the circuit. In order to be acceptable, the cable must withstand the test high voltage without breakdown, have steady or decreasing leakage current during the high potential test, and have satisfactory comparable megger readings in each megger test.
 8. Test ground interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer. Inspection and test procedures outlined in NETA Acceptance Testing Specifications Section 7.14 - Ground Fault Protection Systems - shall also be used.
 9. A functional test and check of all electrical components is required prior to performing subsystem testing and commissioning. Compartments and equipment shall be cleaned as required by other provisions of these Specifications before commencement of functional testing. Inspection and test procedures outlined in NETA ATS Section 8.1 - System Functional Tests - shall be used. Functional testing shall comprise:
 - a. Circuit breakers insulated case or molded shall be tested per the requirements set forth in NETA ATS Section 7.6.1.1. Circuit breakers which have adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field adjusted by a representative of the circuit breaker manufacturer. Time and pickup setting shall correspond to the recommendations of the Short Circuit Study provided by the equipment vendor. Setting shall be tabulated and proven for each circuit breaker in its installed position.
 - b. Switches rated less than 600V shall be tested in accordance with NETA ATS Section 7.5.1.1. Switches shall be toggled, back and or side contacts tested for correct wiring, any special features verified.
 10. Complete ground testing of all grounding electrodes per requirements below prior to operating the equipment. Inspection and test procedures outlined in NETA ATS section 7.13 - Grounding Systems - shall be used.
- B. Subsystem testing shall occur after the proper operation of alarm and status contacts has been demonstrated or otherwise accepted by the DISTRICT and after process control devices have been adjusted as accurately as possible. It is intended that the CONTRACTOR will adjust limit switches and level switches to their operating points prior to testing and will set pressure switches, flow switches, and timing relays as dictated by operating results.
- C. After initial settings have been completed, each subsystem shall be operated in the manual mode and it shall be demonstrated that operation is in compliance with the Contract Documents. Once the manual

mode of operation has been proven, automatic operation shall be demonstrated to verify such items as proper start and stop sequence of pumps, proper operation of valves, proper speed control, etc.

- D. Provide ground resistance tests on the main grounding electrode or system in the presence of the DISTRICT and submit results. Utilize the fall-of-potential method or alternative, in accordance with IEEE Standard 81.
- E. Subsystems shall be defined as individual and groups of pumps, chemical feeders, air conditioning units, ventilation fans, air compressors, etc.
- F. General: Carry out tests indicated herein for individual items of materials and equipment in other Sections.

1.06 INSPECTION COORDINATION:

- A. The CONTRACTOR shall provide access to the work for the DISTRICT as requested for inspection. The CONTRACTOR shall provide 48 hours notice of its intention to begin new work activities

1.07 WARRANTY:

- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in the Contract Documents.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the Contract Documents.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS:

- A. The CONTRACTOR shall provide all testing equipment required which includes but are not limited to following:
 - 1. Wet- and dry-bulb thermometer
 - 2. 1000V meggers
 - 3. Battery-powered portable telephone sets and portable radios
 - 4. Digital High Precision Multimeter
 - 5. Commercial model three-point ground test set
 - 6. Miscellaneous cable, test lights, buzzers, bells, switches, receptacles, plugs, and other equipment as required

PART 3 - EXECUTION: N/A

END OF SECTION