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IFB NO. Y16-776-PH **ISSUED: June 9, 2016**

INVITATION FOR BIDS

FOR

INTERNATIONAL DRIVE POTABLE WATER BOOSTER PUMP STATION

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PART H
TECHNICAL SPECIFICATIONS

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INDEX TO PROJECT MANUAL
ORANGE COUNTY
INTERNATIONAL DRIVE POTABLE WATER
BOOSTER PUMP STATION
BID SET

OCU Sequence No. 74251

CPH Project No. O28426

MAY 2016

DIVISION 0 - BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT PROVIDED BY ORANGE COUNTY PURCHASING

DIVISION 1 -GENERAL REQUIREMENTS

DIVISION 2 -SITEWORK

DIVISION 16 - ELECTRICAL

APPENDICES

SECTION 01001

GENERAL WORK REQUIREMENTS

PART 1 – GENERAL

1.01 NOTICE AND SERVICE

A. In conformance with the requirements of Notice and Service of the General Conditions, all notices or other papers required to be delivered by the Contractor to the County shall be delivered to the Engineering Division, Attn: Chief Construction Inspector.

1.02 WORK TO BE DONE

A. The Contractor shall furnish all labor, materials, equipment, tools services and incidentals to complete all work required by these specifications and as shown on the Drawings, at a rate of progress which will ensure completion of the Work within the Contract Time stipulated.

B. All materials, equipment, skills, tools and labor which is reasonably and properly inferable and necessary for the proper completion of the Work in a substantial manner and in compliance with the requirements stated or implied by these Specifications or Drawings shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.

C. The Contractor shall perform the Work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, clean up, replacements, and restoration required as a result of damages caused during this construction.

D. The Contractor shall comply with all County, State, Federal, and other codes, which are applicable to the proposed construction Work.

E. All newly constructed Work shall be carefully protected from injury in any way. No wheeling, walking, or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the Contractor at his own expense.

F. Scope of Work: See Section 01010 "Summary of Work" and the Bid Schedule for details.

1.03 DRAWINGS AND PROJECT MANUAL

A. The Work shall be performed in accordance with the Drawings and Specifications prepared by the County/Professional. All work and materials shall conform to the Orange County Utilities Standards and Construction Specifications Manual, latest edition or as indicated in these Specifications or Drawings.

B. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the County/Professional, and shall notify same, in writing, of all errors, omissions, conflicts and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting there from, nor from rectifying such conditions at his own expense.

C. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under this Contract.

D. Intent:

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified either in the Drawings or in the Specifications, but involved in carrying out their intent, or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. Such items shall be provided by the Contractor in accordance with the specification on the Drawings.
3. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.
4. Reference to the following standards of any technical society, organization or body shall be construed to mean the latest standard, code or specification or tentative specification adopted and published at the date of advertisement for bids, even though reference has been made to an earlier standard. Such reference is hereby made a part of the Contract the same as if herein repeated in full and in the event of any conflict between any of these specifications, standard codes or tentative specifications and the Contract Documents, the most stringent shall govern.

AA	Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	American Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASA	American Standards Association (now ANSI)
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASTM	American Society for Testing and Materials

AWPA	American Wood Preservers Association
AWBP	American Wood Preservers Board
AWS	American Welding Society
AWWA	American Water Works Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DOT Spec	Standard Specification for Road and Bridge Construction – Florida Department of Transportation
FAC	Florida Administrative Code
FS	Federal Standard
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPT	National Pipe Threads
NSF	National Science Foundation
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council
UL	Underwriter's Laboratories, Inc.
USASI	United States of American Standards Institute (Now ANSI)

E. When obtaining data and information from the Drawings, conflicts, errors, and discrepancies shall be resolved from the documents given the following order of precedence:

1. Agreement
2. Change Orders
3. Addenda
4. Supplementary Conditions
5. Instructions to Bidders
6. General Conditions
7. Specifications (Div. 1 through 16)
8. Drawings
9. Dimensions

   When measurements are affected by conditions already established or where items are to be fitted into constructed conditions, it shall be the Contractor's responsibility to verify all such dimensions at the site and the actual job dimensions shall take precedence over scale and figure dimensions on the Drawings.
10. Full-size Drawing
11. Large-scale Drawing
12. Small-scale Drawing
13. Advertisement for Bids

14. Bid
15. Bonds
16. Insurance Certificates
17. Insurance Endorsements
18. Affidavits

1.04 PROTECTION AND RESTORATION

A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every means of protection necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the County/Professional.

B. Protection of Trees and Shrubs:
   1. Protect with boxes or other barricades
   2. Do not place excavated material so as to injure trees or shrubs
   3. Install pipelines in short tunnels between and under root systems
   4. Support trees to prevent root disturbance during nearby excavation

C. Tree and Limb Removal
   1. Tree limbs, which interfere with equipment operation and are approved for pruning, shall be neatly trimmed and the tree cut coated with tree paint.
   2. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. The Contractor shall obtain any permits required for removal of trees. Ordered tree removal shall be paid for under the appropriate Contract Items.

E. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.

D. Lawn Areas - All lawn areas disturbed by construction shall be replaced with like kind to a condition similar or equal to that existing before construction. Where sod is to be removed, it shall be carefully removed, and the same resodded, or the area where sod has been removed shall be restored with new sod in the manner described in the applicable section. Any disturbed area without sod shall be graded and sodded.

E. Fences - Any fence, or part thereof, that is damaged or removed during the course of the Work shall be replaced or repaired by the Contractor, and shall be left in as good a condition as before the starting of the Work.

F. Where fencing, walls, shrubbery, grass strips or area must be removed or destroyed incident to the construction operation, the Contractor shall, after completion of the Work, replace or restore to the original condition all such destroyed or damaged landscaping and improvements.

G. The cost of all labor, materials, equipment, and work for restoration shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

1.05 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.

B. Sound levels measured by the County/Professional shall not exceed 45 dBA from 8 p.m. to 8 a.m. or 55 dBA 8 a.m. to 8 p.m. This sound level shall be measured at the exterior of the nearest exterior wall of the nearest residence. Levels at the equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the County/Professional for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to, completion dates and bid amounts.

E. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.06 CONTRACTOR'S PAYMENTS TO COUNTY FOR OVERTIME WORK

A. County Inspector Work Hours: Normal work hours for the County's inspector(s) are defined as any eight (8) hour period between the hours of 7:00 a.m. and 7:00 p.m. on the weekdays of Monday through Friday. Any County's Inspector(s) work beyond the aforementioned normal work hours shall be requested in writing 48 hours in advance. All overtime and weekend work compensation to the County's Inspector(s) for working beyond the normal working hours are considered overtime compensation and shall be paid for by the Contractor at the overtime pay rate of $50 per hour. This overtime pay rate is subject to adjustment by the County. The Contractor agrees that the County shall deduct charges for work outside normal work hours and for overtime pay from payments due the Contractor.

1.07 MAINTENANCE OF SERVICE

A. The proposed work for this project involves the connection to a live, water transmission main within a County owned property. The work also involves connecting to a live 36" potable water transmission main. The CONTRACTOR shall perform their work, taking all proper precautions and safety measures to insure a safe work area. The work shall be so conducted to maintain existing utility systems in operation. All utilities that occupy or are adjacent to the subject construction site are to remain in operation. The CONTRACTOR shall coordinate all construction activities with the Orange County Inspectors and submit a plan for review.

B. The Contractor shall, prior to interrupting any utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the County and make arrangements for the interruption which will be satisfactory to the County.

C. Utility lines that are damaged during construction shall be repaired by the Contractor and service restored within 4 hours of the breakage.

1.08 TRANSFER OF SERVICE

A. The Contractor shall use temporary plugs or jumper connection in the proposed water lines to control the flow to the facility during the transfer period. The proposed pumping facility shall be constructed while the existing water main is in operation. When the County has accepted the proposed facilities and placed the facility into operation, the transfer of service is complete. The Contractor may begin the work of removing the bypass pumping

equipment.

1.09 LABOR

A. Supervision - The Contractor shall keep the Contract under his own control and it shall be his responsibility to see that the Work is properly supervised and carried on faithfully and efficiently. The Contractor shall supervise the Work personally or shall have a competent, English speaking superintendent or representative, who shall be on the site of the Project at all working hours, and who shall have full authority by the Contractor to direct the performance of the Work and make arrangements for all necessary materials, equipment, and labor without delay.
B. Jurisdictional Disputes - It shall be the responsibility of the Contractor to pay all costs that may be required to perform any of the Work shown on the Drawings or specified herein to avoid any work stoppages due to jurisdictional disputes. The basis for subletting work in question, if any, shall conform with precedent agreements and decisions on record with the Building and Construction Trades Department, AFL-CIO, dated June, 1973, including any amendments thereto.
C. Apprenticeship - The Contractor shall comply with all of the requirements of Section 446, Florida Statutes, for all contracts in excess of $25,000 excluding roadway, highway or bridge contracts and the Contractor agrees to insert in any subcontract under this Contract the requirements of this Article.

1.10 MATERIALS AND EQUIPMENT

A. Manufacturer
    1. All transactions with the manufacturers or Subcontractors shall be through the Contractor, unless the Contractor shall request and at the County/Professional's option, that the manufacturer or Subcontractor communicate directly with the County/Professional. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
    2. All workmanship and materials shall be of the highest quality. The equipment shall be the product of manufacturers who are experienced and skilled in the field with an established record of research and development. No equipment will be considered unless the manufacturer has designed and manufactured equipment of comparable type and size and have demonstrated sufficient experience in such design and manufacture.
    3. All materials and equipment furnished by the Contractor shall be subject to the inspection, review and acceptance of the County. No material shall be delivered to the work without prior approval of the County/Professional.
    4. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Project shall be the new (most current production at time of bid) and unused standard products of recognized reputable manufacturers.
    5. Manufactured and fabricated products:
        a. Design, fabricate and assemble in accord with the best engineering and shop practices.
        b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
        c. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.
        d. Products shall be suitable for service conditions as specified and as stated by manufacturer.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
f. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.11 MANUFACTURER'S SERVICE

A. Where service by the manufacturer is specified to be furnished as part of the cost of the item of equipment, the Work shall be at the Contractor's expense.
B. The services provided shall be by a qualified manufacturer's service representative to check and verify the completed installation, place the equipment in operation, and instruct the County's operators in the operation and maintenance procedures. Such services are to be for period of time and for the number of trips specified. A working day is defined as a normal 8-hour working day on the job and does not include travel time.
C. The services shall further demonstrate to the County/Professional's complete satisfaction that the equipment will satisfactorily perform the functions for which it has been installed. See also Section 01650 "Pump Station Start-up and Testing".

1.12 INSPECTION AND TESTING

A. General
1. If, in the testing of any material or equipment, it is ascertained by the County/Professional that the material or equipment does not comply with the Contract, the Contractor shall be notified thereof, and he will be directed to refrain from delivering said material of equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material, without cost to the County.
2. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEE, except as may otherwise be stated herein.

B. Cost
1. County shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or specified in the Specifications and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.
2. The cost of field leakage and pressure tests and shop tests of materials and equipment specifically called for in the Contract Documents shall be borne by the Contractor, and such costs shall be deemed to be included in the Contract price.
3. Notify County employed laboratory a minimum of 48 hours sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. When tests or inspections cannot be performed after such notice, reimburse County for laboratory personnel and travel expenses incurred.
4. The Contractor shall pay for all Work required to uncover, remove, replace, retest, etc. any Work not tested due to the Contractor's failure to provide the 48-hours advance notice or due to failed tests. The Contractor shall also provide compensation for the County/Professional's personnel for required re-testing due to failed or rescheduled testing.

C. Shop Testing
1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency,

performance, function or special requirements are specified shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the worksite until the County/Professional notifies the Contractor, in writing, that the results of such tests are acceptable.

2. Five copies of the manufacturer's actual shop test data and interpreted results thereof, accompanied by a certificate of authenticity notarized and signed by a responsible official of the manufacturing company, shall be furnished to the County/Professional as a prerequisite for the acceptance of any equipment. The cost of shop tests (excluding cost of County's representative) and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor and shall be included in the Contract price.
3. The Contractor shall give notice in writing to the County sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the County shall arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials; or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture; or he will notify the Contractor that inspection will be waived.
4. When inspection is waived or when the County/Professional so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include five (5) copies of the results of physical tests and chemical analysis, where necessary, that have been made directly on the product or on similar products of the manufacturer.
5. The Contractor must comply with these provisions before shipping any material. Such inspections by the County shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Field Testing:

1. The County shall employ and pay for services of an independent testing laboratory to perform testing specifically indicated in the Contract Documents. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract. The Contractor shall provide compensation for retesting of all failed tests.
2. The County may at any time during the progress of the Work, request additional testing beyond that which is specified in the Contract. This testing will be at the County's expense. The Contractor shall assist the testing laboratory personnel in all ways so as to facilitate access to the location of the material or equipment to be tested. Contractor shall:
    a. Cooperate with laboratory personnel, provide access to the Project.
    b. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
    c. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes, which require control by the testing laboratory.
3. The following schedule summarizes the responsibilities of various tests that may be required by the Contract Documents. Contractor shall notify the County in advance

of work so that arrangements can be made with the testing laboratory.

TEST	NOTES	PAID FOR
Soil Compaction	Pipe Work: Every 300 ft. at each lift of compaction Structures: As a minimum one test per 2000 SF of fill area per lift, or at least 2 tests per structure, per lift. As specified in material specifications sections	County
Low Pressure Air Exfiltration	Each section of gravity sewer pipe between manholes or lift station	Contractor
Hydrostatic Pressure	All segments of pressure piping (24-hour test).	Contractor
Hydrostatic Leakage	All segments of pressure piping (2-hour test).	Contractor
Bacteriological	As required by local and state agencies	County
Asphaltic Concrete Paving	As required by County	County
LBR	Each 600 SY of pavement	County
Concrete	Slump test each delivery, cylinders every 20 CY	County
All Other Testing	As specified in various sections of the Project Manual	As Indicated

E. Demonstration Tests: Upon completion of the Work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance or demonstration tests as specified or required to provide compliance with the Contract Documents. The Contractor shall furnish all labor, fuel, energy, water and all other equipment necessary for the demonstration tests at no additional cost to the County.

F. Final Inspection: Prior to preparation of the final payment application, a final inspection will be performed by the County to determine if the Work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents. See also Section 01700 "Project Closeout".

G. Inspection by existing utility owners: The Contractor shall pay for all inspections during the progress of the Work required and provided by the owner of all existing public utilities paralleling or crossing the Work, as shown on the Drawings. All such inspection fees shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

H. Inspection by Other Agencies: The Florida Department of Transportation, the Florida Department of Environmental Protection, and other authorized governmental agencies shall have free access to the site for inspecting materials and Work, and the Contractor shall afford them all necessary facilities and assistance for doing so. Any instructions to the Contractor resulting from these inspections shall be given through the County. These rights of inspections shall not be construed to create any contractual relationship between the Contractor and these agencies.

1.13 PROJECT SITE AND ACCESS

A. RIGHT-OF-WAY AND EASEMENTS

1. The use of public streets and alleys shall be such as to provide a minimum of inconvenience to the public and to other traffic. Any earth or other excavated material spilled from trucks shall be removed by the Contractor and the streets

cleaned to the satisfaction of the County.

2. The Contractor shall not enter or occupy private land outside of easements, except by written permission of the property owner.
3. At the time of the Pre-Construction meetings, the Contractor shall fully acquaint himself with the status of all easements required for the Work and the possibility of parcels remaining to be acquired, if any. Should easements not be acquired by the County in specific areas of the Work, the Contractor shall sequence and reschedule his work therein so as not to interfere with the progress of work in other areas of the Project. Such rescheduling of Work shall be performed by the Contractor at no additional cost to the County. The County agrees that it will make every effort to acquire all remaining easements with all speed and diligence possible so as to allow the completion of the Work within the Contract time.

B. ACCESS

1. Neither the material excavated nor the materials or equipment used in the construction of the Work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.
2. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business access with the business owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored and all construction debris removed within 48 hours of backfilling trench.
3. Contractor agrees that representatives of the County and any governmental agents will have access to the Work wherever it is in preparation or progress and that the Contractor shall provide facilities for such access and inspection.

1.14 UTILITIES

A. UTILITY CONSTRUCTION

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto, whether owned or controlled by governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage or water. Other public or private property, which may be affected by the Work, shall be deemed included hereunder.
2. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.
3. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits described by the County. If any excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures. As a minimum, the Contractor shall conform to the following restoration procedures:
    a. Interim Restoration: All excavations shall be backfilled and compacted as specified by the end of each working day. Contractor shall coordinate his

construction activity including density tests and inspections to allow sufficient time to achieve this requirement. All driveway cuts shall be backfilled, compacted, and limerock base spread and compacted immediately after installation. Contractor shall coordinate with the individual property owners prior to removing the driveway section. Any utility crossing an existing roadway, parking lot or other paved area shall be patched by the end of the working day.

b. All pipe and fittings shall be neatly stored in a location, which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.

c. Final Restoration Overlay: After completing all installations, and after testing of the pipe, final restoration shall be performed. In no event shall final restoration begin after substantial completion. Final restoration shall provide a S-III asphaltic overlay as specified in an uninterrupted continuous operation until completion. Any additional restoration required after testing shall be repaired in a timely manner at no additional cost to the County.

d. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction. The Contractor's Progress Schedule shall reflect the above restoration requirements.

e. Additional Restoration for Work in Business or Commercial Districts: The Contractor shall restore all private property, damaged by construction, to its original condition. Access to residents and properties located adjacent to the project site must be maintained at all times. Property drainage and grading of adjacent properties shall be restored within 24 hours of backfilling trench.

B. EXISTING UTILITIES

1. The locations of all existing underground piping, structures and utilities have been taken from information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping, conduit and cables to be encountered.

2. The Contractor shall, at all times in performance of the Work, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of existing public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services; and shall cooperate fully with the owners thereof to that end.

3. Pipelines shall be located substantially as indicated on the Drawings, but the County reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. When the location of piping is dimensioned on the Drawings, it shall be installed in that location; when the location of piping is shown on a scaled drawing, without dimensions, the piping shall be installed in the scaled location unless the County approves an alternate location for the piping. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required. The County/Professional may require detailed pipe laying drawings and schedules for project control.

4. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities, which do not interfere with the completed Work, shall be

carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County. Any existing facilities, which require operation to facilitate repairs, shall be operated only by the owner of the respective utility.

5. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the proximity of excavation, be temporarily stayed and/or shored in position while Work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.

C. NOTICES

1. All governmental utility departments and other owners of public utilities, which may be affected by the Work, will be informed in writing by the Contractor two (2) weeks after the execution of the Contract or Contracts covering the Work. Such notice will be sent out in general, and directed to the attention of the governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the Work.
2. The Contractor shall also comply with Florida Statute 553.851 regarding notification of existing gas and oil pipeline company owners. Evidence of such notice shall be furnished to the County within two weeks after the execution of the Contract.
3. It shall be the Contractor's responsibility to contact utility companies at least 72 hours in advance of breaking ground in any area or on any unit of the Work so maintenance personnel can locate and protect facilities, if required by the utility company.
4. The Contractor shall give a minimum 5 working day notice prior to utility personnel interrupting a utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the utility owner and make arrangements for the utility personnel to isolate the existing lines thus providing interruption which will be satisfactory to the utility owner.

D. EXPLORATORY EXCAVATIONS

1. Exploratory excavations shall be conducted by the Contractor for the purpose of locating underground pipelines or structures in advance of the construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48 hours or 1000 feet in advance of Work. If there is a potential conflict, the Contractor is to notify the County/Professional immediately. Information on the obstruction to be furnished by the Contractor shall include: Location, Elevation, Utility Type, Material and Size. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the County.

E. UTILITY CROSSINGS

1. It is intended that wherever existing utilities must be crossed, deflection of the pipe within specified limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the County this procedure is not feasible, he may direct the use of fittings for a utility crossing or conflict transition as detailed on the Drawings.

F. RELOCATIONS

1. Relocations shown on the Drawings - Public utility installations or structures, including but not limited to light poles, signs, fences, piping, conduits and drains that interfere with the positioning of the Work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.
2. Relocations not shown on the Drawings
    a. Where public utility installations or structures are encountered during the course of the Work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the County, removal, relocation, replacement or rebuilding is necessary to complete the Work under this contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the County, for the Contractor to accomplish.
    b. If such Work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such Work is accomplished by the Contractor, it will be paid for as a Change Order.
3. All existing castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished Work.
4. All existing utility systems which conflict with the construction of the Work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

1.15 RELATED CONSTRUCTION REQUIREMENTS

A. BARRIER AND LIGHTS

1. The Contractor shall exercise extreme care in the conduct of the Work to protect health and safety of the workmen and the public. The Contractor shall provide all protective measures and devices necessary, in conformance with applicable local, state and federal regulations regarding their need and use. Protective measures shall include but are not limited to barricades, warning lights/flashers and safety ropes.
2. All equipment and vehicles operating within ten (10) feet of the roadway shall have flashing strobe lights attached.

B. DEWATERING AND FLOTATION

1. The Contractor, with his own equipment, shall do all pumping necessary to dewater any part of the Work area during construction operations to insure dry working conditions. The Contractor shall be completely responsible for any tanks, wet wells or similar structures that may become buoyant during the construction and modification operations due to the ground water or floods and before the structure is

put into operation. The proposed final structures have been designed against buoyancy; however the Contractor may employ methods, means and techniques during the various stages of construction (or other conditions), which may affect the buoyancy of structures. Should there be any possibility of buoyancy of a structure, the Contractor shall take the necessary steps to prevent its buoyancy either by increasing the structure's weight, by filling it with approved material or other acceptable methods. Damage to any structures due to floating or flooding shall be repaired or the structures replaced at the Contractor's expense.

C. DUST AND EROSION CONTROL

1. The Contractor shall prevent dust nuisance from his operations or from traffic by the use of water and deliquescent salts.
2. Erosion and Sedimentation Control
    a. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the County, FDEP and any other agency having jurisdiction.
    b. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the County, FDEP and any other agency having jurisdiction.
    c. The construction of temporary erosion and sedimentation control facilities shall be in accordance with the technical provision of section 104-6.4 of the 1991 Edition, FDOT Standard Specifications for Road and Bridge Construction.
    d. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

D. LINES AND GRADES

1. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the County/Professional. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the project control points set by the County, and shall be solely responsible for the accuracy thereof.
3. Water main and forcemain shall have a minimum of 36-inches of cover over the top of the pipe. Cover shall vary to provide long uniform gradient or slope to pipe to minimize air pockets and air release valves. The stationing shown on the Drawings for air and vacuum release valve assemblies are approximate and the Contractor shall field adjust these locations to locate these valves at the highest point in the pipeline installed. All locations must be acceptable by the County.
4. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:
    a. Gravity lines: continuous control, using laser beam technology.

b. Pressure lines; control stakes set at 50 ft intervals using surveyors' level instrument.

E. CUTTING AND PATCHING

1. The Contractor shall do all cutting, fitting or patching of his portion of the Work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the County and in accordance with the Drawings and Specifications.
2. Preparation:
   a. Inspect the existing conditions of the Project, including elements subject to damage and/or movement during cutting and patching.
   b. Provide adequate temporary support to assure the structural integrity of all facilities during completion of the Work.
3. Performance:
   a. Execute cutting and demolition by methods, which will prevent damage to other existing facilities and will provide proper surfaces to receive installation of equipment and repair.
   b. Excavation and backfilling shall be performed in a manner, which will prevent settlement and/or damage to existing facilities.
   c. All pipes, sleeves, ducts, conduits and other penetration through surfaces shall be made airtight.
   d. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

F. TEMPORARY CONSTRUCTION

1. Temporary fences: If, during the course of the Work, it is necessary to remove or disturb any fencing, the Contractor shall at his own expense, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The County/Professional will be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.
2. Responsibility for Temporary Structures: In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation and will indemnify and save harmless the County from all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

G. DAILY REPORTS

1. The Contractor shall submit to the County's Representative daily reports of construction activities including non-work days. The reports shall be complete in detail and shall include the following information:
   a. Days from Notice to Proceed; Days remaining to substantial and final completion.
   b. Weather information
   c. Work activities with reference to the Critical Path Method (CPM) schedule activity numbers (including manpower, equipment and daily production quantities for each individual activity.)
   d. Major deliveries
   e. Visitors to site

f. Test records
g. New problems, and
h. Other pertinent information

2. A similar report shall be submitted for/by each Subcontractor.
3. The report(s) shall be submitted to the County Representative's Field Office within two (2) days of the respective report date. Each report shall be signed by the Contractor's Superintendent or Project Manager. Pay request will not be processed unless daily reports are current.
4. If a report is incomplete, in error, or contains misinformation, a copy of the report shall be returned by the County Representative to the Contractor's Superintendent or Project Manager with corrections noted. When chronic errors or omissions occur, the Contractor shall correct the procedures by which the reports are produced.

H. CLEANING

1. During Construction
   a. During construction of the Work, the Contractor shall, at all times, keep the site of the Work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the County, such material, debris, or rubbish constitutes a nuisance or is objectionable.
   b. Provide on-site containers for the collection of waste materials, debris and rubbish and remove such from the site periodically by disposal at a legal disposal area away from the site.
   c. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces. Use only those cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
   d. The Contractor shall remove from the site all surplus materials and temporary structures when no longer necessary to the Work at the direction of the County.

2. Final Cleaning
   a. At the conclusion of the Work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances. Employ skilled workmen for final cleaning. Thoroughly clean all installed equipment and materials to a bright, clean, polished and new appearing condition. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
   b. The Work shall be left in a condition as shown on the Drawings and the remainder of the site shall be restored to a condition equal or better than what existed before the Work.
   c. Prior to final completion, or County occupancy, Contractor shall conduct an inspection of interior and exterior surfaces, and all work areas to verify that

the entire Work is clean. The County will determine if the final cleaning is acceptable.

1.16 CONSTRUCTION NOT PERMITTED

A. USE OF EXPLOSIVES

No blasting shall be done except upon approval by the County and the governmental agency or political subdivision having jurisdiction. When the use of explosives is approved by the County as necessary for the execution of the Work, the Contractor shall use the utmost care so as not to endanger life or property, and assume responsibility for any such damage resulting from his blasting operations, and whenever directed, the number and size of the charges shall be reduced. All explosives shall be stored in a secure manner and all such storage places shall be marked clearly, "DANGEROUS EXPLOSIVES" and shall be in care of competent watchmen. All permits required for the use of explosives shall be obtained by the Contractor at his expense. All requirements of the governmental agency issuing permit shall be observed.

PARTS 2 - PRODUCTS (NOT USED)

PARTS 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. **Pumps & Piping:** The Project consists of the installation of a new potable water pressure booster pump building equipped with two (2) 4,000 gallon per minute (gpm) potable water booster pumps with variable frequency drive units, provisions for three (3) future pumps, and all associated suction and discharge piping, valves, electrical conduits, and instruments. The project includes an aboveground static mixer, flow meter station with 24-inch piping, approximately 1,400 lineal feet of 36-inch potable water main, approximately 68 lineal feet of 12-inch potable water line, valves, fittings, three (3) motor actuators for one (1) existing and two (2) new 36-inch valves, and two (2) connections to an existing 36-inch potable water main via 36" tapping sleeve and valves.

Building: Project includes a new concrete block building on a concrete slab. The new building includes a ventilated pump room with concrete pump bases and a pipe trench with grating, an overhead hoist and trolley system, a future sodium hypochlorite room, an air-conditioned electrical room, an air-conditioned restroom and a storage room.

Sitework: Civil site work includes site clearing, grading, installation of stormwater swales, fencing around building, new chain link fencing and gate at access entrance road Hunter's Creek subdivision off of Town Center Boulevard as shown on Construction Drawing No. G200, motorized gate at pump station site, manway gate, graveling and resurfacing two existing Orange County Utility Department's gravel access roads during and after construction, temporary silt fencing, asphalt driveway, sidewalks, curb and gravel areas, wastewater holding tank, and finishing of the site as shown on the drawings and described in these specifications.

Electrical & Instrumentation: Project includes all associated electrical work, including but not limited to electrical service to the site, coordination with Duke Energy for new power pole and transformer to site (services by Duke Energy to be paid by County) conduits, wires, lightning protection, electrical gear, VFDs, chlorine analyzer, and all electrical items to make a complete working pumping station. The project also includes instrumentation and a control system to operate the facility. Contractor to provide the controls at the project site location as well as modifications to the County's main SCADA system programming at the eastern water supply.

Materials used to complete the Work shall be listed in the List of Approved Products – Appendix D of the Orange County Standards and Construction Specifications Manual which is provided in **Appendix 3** of this document. The work associated with this project is within property owned by Orange County. All work activities shall be required to be coordinated with the County to avoid any disruptions to the operation of the existing water mains. All work performed will be required to be done while maintaining the functional operation of the water mains. All work

activities shall be required to be in accordance with the permits issued by the respective agencies.

B. All materials, equipment, skills, tools, and labor which is reasonably and properly inferable and necessary for the proper completion of the Work and in compliance with the requirements stated or implied by these Specifications or Drawings shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.

C. Construct the Project under a Lump Sum Price Contract.

D. The Contractor shall perform the work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, clean up, replacements, and restoration required as a result of disruptions caused during this construction.

1.02 WORK SEQUENCE

The Contractor's sequence of work may be of his choosing in order to complete the work in the allowed time frame. The Contractor shall submit a schedule and work sequence to the County at least five (5) days prior to the Notice to Proceed. If work sequence of operations will require a shutdown of any existing County utility systems, the Contractor shall provide in writing a detailed shut down plan that will be reviewed by the County prior to the commencement of that work.

1.03 WORKING HOURS

A. Normal working hours for the project shall be a ten (10) hour period between the hours of 7:00 a.m. – 7:00 p.m., Monday through Friday. Should the Contractor request and the County approves the Contractor to work periods greater than 8 hours a day, he shall make such requests in writing a minimum of 72 hours prior to such work periods. The Contractor shall pay the cost of $50.00 per hour for inspection by the County's inspection representatives for any hours worked in excess of 8 hours per day or 40 hours per week worked outside the normal work hours for the project.

B. The Contractor may be required to perform certain work at times of the day or night when system flows, vehicular traffic and pedestrian traffic are at diminished levels and at times appropriate to other activities which are occurring that may affect the project. The Contractor shall comply with requirements to alter his schedule of work as requested or required by Orange County without change to the contract price or time.

1.04 CONTRACTOR USE OF PREMISES

Confine operations at the site to areas permitted by applicable laws, ordinances, permits, and by the Contract Documents. Do not unreasonably encumber the site with materials or equipment. The Contractor shall assume full responsibility for protection and safekeeping of products stored on the job site. Contractor shall not encumber the area of the site located south of the existing chain link fence which is part of the Westerly Effluent Discharge Site (WEDS).

1.05 DRAWINGS AND PROJECT MANUAL

A. The Work shall be performed in accordance with the Drawings and Specifications prepared by CPH, Inc., 1117 E. Robinson Street, Orlando, Florida 32801.

B. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the County, and shall notify same, in writing, of all errors, omissions, conflicts and discrepancies found therein with adequate notice. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting therefrom, nor from rectifying such conditions at his own expense.

C. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under this Contract.

D. Intent

1. All work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their implied intent, or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. Such items shall be provided by the Contractor in accordance with the specification on the Drawings.
3. The apparent silence of the Specifications to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

1.06 WEATHER

During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the County as to suspensions shall be final and binding. During suspension of the Work from any cause, the Work shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise; and, if the County will so direct, the rubbish and surplus materials shall be removed.

1.07 PROTECTION AND RESTORATION

A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every means of protection necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the County.

B. Contractor shall protect the existing background groundwater monitoring well located within a fenced area on the site.

C. Protection of Trees and Shrubs
   1. Protect with boxes or other barricades.
   2. Do not place excavated material so as to injure trees or shrubs.
   3. Support trees to prevent root disturbances during nearby excavation.

D. Tree and Limb Removal
   1. Contractor shall remove all trees and stumps in the locations shown on the construction drawings.
   2. Tree limbs that interfere with equipment operation and are approved for pruning shall be neatly trimmed and the tree cut coated with tree paint. Trimming and removal of tree limbs shall be incidental.
   3. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. The Contractor shall obtain any permits required for removal of trees. Ordered tree removal shall be paid for under the appropriate Contract Items.

E. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.

F. All lawn areas disturbed by construction shall be replaced with like kind to a condition similar or equal to that existing before construction. Where sod is to be removed, it shall be carefully removed, and the same resodded, or the area where sod has been removed shall be restored with new sod in the manner described in the applicable section.

G. The Contractor shall be responsible for locating and protecting and/or relocating all utilities lines, including irrigation lines, in the areas of the construction activities. If any existing lines are broken or damaged as a result of construction activities, the Contractor shall be responsible for repairing the lines, at no additional cost to the County, to existing or better condition and fully functional.

1.08 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. Comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to all parties involved in the installation, including two (2) copies for the Engineer's use. Maintain one (1) set of complete instructions at the job site during installation and until completion. Copies of all instructions shall also be included in the Operation and Maintenance Manuals, which are provided to the County at the close of the contract.

B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with the manufacturer's instructions, consult with the Engineer for further instructions. Do not proceed with Work without clear instructions.

C. Perform Work in strict accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

D. The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the installation of the Work and to handle all emergencies normally encountered in Work of this character.

E. Equipment shall be installed in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise in writing by the County during installation.

F. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

G. The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the County and made of ample size and strength for the purposes intended. The manufacturer shall furnish substantial templates and working drawings for installation.

1.09 CONSTRUCTION FIELD ENGINEERING

A. The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida for the following specific services as applicable to the Work:
   1. Identify existing easement lines, rights-of-ways and property lines along or adjacent to the Work;
   2. Locate all existing utilities and structures as may be affected by the Work;
   3. Locate control points prior to starting the Work;
   4. Replace control points or reference points which may be lost or destroyed;
   5. Prepare a certified survey of the actually constructed facilities based on information concurrent with the construction progress. This site survey shall be referred to as the Contractor's "Project Record Drawings". The Project Record Drawings shall be prepared at the same scale as the Contract Drawings on reproducible sheet (24" x 36"). Where the Contract Drawings are at various scales, the Project Record Drawings shall be at the scale, which shows the greatest detail. The Project Record Drawings shall indicate the actual locations of all building corners, structures and elevation and stationing (minimum 100 ft. stationing) of all piping, fittings, valves, conduits, existing utilities and all other above and below ground improvements constructed under this contract. The certified survey shall be in accordance with Section 01720.

B. The Contractor shall protect control points prior to starting the Work and shall preserve all permanent reference points during construction. Report to the County when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

C. The Contractor shall bear the cost of re-establishing project control points if disturbed, and bear the entire expense of rectifying Work improperly installed due to

not maintaining or protecting or to removing without authorization such established points, stakes, and marks.

D. Submittals

1. Certificate signed by a Registered Surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.
2. Reproducible drawings showing locations of all structures, piping conduits and other improvements. These drawings are referenced as the Project Record Drawings and shall be included with the Project Record Documents.
3. Documentation to verify accuracy of field engineering work when requested by the County.
4. Electronic version of record drawing survey in the latest version of AutoCAD.

1.10 UTILITIES

A. Utility Construction

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto, whether owned or controlled by governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage or water. Other public or private property, which may be affected by the Work, shall be deemed included hereunder.
2. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.
3. The length of open trench will be controlled by the particular surrounding conditions, but shall always be no more than 300 feet. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures. At a minimum, the Contractor shall conform to the following restoration procedures:
    a. Interim Restoration
        (1) All excavations shall be backfilled and compacted as specified by the end of each working day. For excavations within existing paved areas, limerock base or soil cement base (match existing) shall be spread and compacted to provide a relatively smooth surface free of loose aggregate material.
        (2) All pipe and fittings shall be stored in a location inside County property, which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.
    b. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction.
    c. The Contractor's Progress Schedule shall reflect the above restoration requirements.

B. Existing Utilities

1. The proposed work for this project involves the connection to a live, water transmission main within a County utility easement. The Contractor shall perform their work, taking all proper precautions and safety measures to ensure a safe work area. The work shall be so conducted to maintain existing utility systems in operation. All utilities that occupy or are adjacent to the subject construction site are to remain in operation. All utilities that occupy or are adjacent to the subject construction site are to remain in operation. The Contractor shall coordinate all construction activities with the County Inspectors and submit a plan for review.
2. The locations of all existing underground piping, structures and utilities have been taken from information received from the respective utility owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered.
3. The Contractor shall, at all times in performance of the Work, employ approved methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of existing public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services; and shall cooperate fully with the owners thereof to that end.
4. Pipelines shall be located substantially as indicated on the Drawings, but the County reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. When the location of piping is dimensioned on the Drawings, it shall be installed in that location; when the location of piping is shown on a scaled drawing, without dimensions, the piping shall be installed in the scaled location unless the County approves an alternate location for the piping. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required. The Engineer may require detailed pipe laying drawings and schedules for project control.
5. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities, which do not interfere with the completed Work, shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County. Any existing facilities, which require operation to facilitate repairs, shall be performed only by the owner of the respective utility.
6. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the proximity of excavation, be temporarily stayed and/or shored in position while Work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.
7. The Contractor shall be responsible for locating and protecting and/or relocating all utilities lines, including irrigation lines, in the areas of the construction activities. If any existing lines are broken or damaged as a result of construction activities, the Contractor shall be responsible for repairing the lines, at no additional cost to the County, to existing or better condition and

fully functional.

C. Notices

1. All governmental utility departments and other owners of public utilities, which may be affected by the Work, will be informed in writing by the Contractor within two (2) weeks after the execution of the Contract or Contracts covering the Work. Such notice will be sent out in general, and directed to the attention of the governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the Work.
2. The Contractor shall also comply with Florida Statute 553.851 regarding notification of existing gas and oil pipeline company owners. Evidence of such notice shall be furnished to the owners within two (2) weeks after the execution of the Contract.
3. It shall be the Contractor's responsibility to contact utility companies at least 48 hours in advance of breaking ground in any area or on any unit of the Work so maintenance personnel can locate and protect facilities, if required by the utility company.
4. The Contractor shall, prior to interrupting a utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the utility owner and make arrangements for the interruption which will be satisfactory to the utility owner. Contractor to provide a minimum of seven (7) days' notice with a County Authorized Representative.

D. Exploratory Excavations

Exploratory excavations shall be conducted by the Contractor for the purpose of locating underground pipelines or structures in advance of the construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48 hours or 1000 feet in advance of Work. If there is a potential conflict, the Contractor is to notify the County immediately. Information on the obstruction to be furnished by the Contractor shall include: Location, Elevation, Utility Type, Material and Size. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the County.

E. Utility Crossings

It is intended that whatever existing utilities must be crossed, deflection of the pipe within specified limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the County this procedure is not feasible, he may direct the use of fittings for a utility crossing or conflict transition as detailed on the Drawings.

F. Relocations

1. Relocations shown on the Drawings – Public utility installations or structures, including but not limited to light poles, signs, fences, piping, conduits and drains that interfere with the positioning of the Work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work

and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.

2. Relocation not Shown on the Drawings
   a. Where public utility installations or structures are encountered during the course of the Work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the County, removal, relocation, replacement or rebuilding is necessary to complete the Work under this contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the County, for the Contractor to accomplish. A Request For Proposed Change will be issued by the Engineer.
   b. If such Work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such Work is accomplished by the Contractor, it will be paid for as a Change Order after approval of the Request For Proposed Change.
3. All existing utility castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished Work.
4. All existing utility systems which conflict with the construction of the Work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

G. Lines and Grades
1. All Work under this Contract shall be constructed in accordance with the line and grades shown on the Drawings, or as given by the County. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the project control points set by the County, and shall be solely responsible for the accuracy thereof.
3. Water main shall have a minimum of 36-inches of cover over the top of the pipe, and with adequate bury depth to accommodate vertically installed gate valves (except where horizontal gate valves are specifically identified on the drawings). Cover shall vary to provide long uniform gradient or slope to pipe to minimize air pockets and air release valves. The locations shown on the Drawings for air release valve assemblies are approximate and the Contractor shall field adjust these locations to locate these valves at the highest point in the pipeline installed. All locations must be approved by the County.
4. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:
   a. Gravity Lines
      Continuous control, using laser beam technology.
   b. Pressure Lines
      Control stakes set at 50 ft intervals using surveyor's level instrument.

1.11 SPECIAL PROJECT PROCEDURES

A. Construction Phasing

Construction of the project shall be in accordance with the construction schedule. Contractor shall adjust the schedule to provide for utility installations at no additional cost to the County.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01021
SOILS REPORT AND OTHER INFORMATION

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Identification of reports of existing conditions.

B. Bidder's/Contractor's responsibilities for investigating and working with existing conditions.

1.02 LAND IN-ADDITION TO THE SITE

A. Contractor is responsible for obtaining any lands, areas, properties, facilities and easements, in addition to those furnished by the County, that the Contractor considers necessary for temporary facilities, storage, disposal of spoil or waste material or other purposes the Contractor determines necessary to complete the Work. Contractor shall provide written documentation from owner to use such land or facilities The County and Geotechnical Engineer do not assume any responsibility for existing conditions at such lands, areas, properties, facilities and/or easements obtained by the Contractor.

1.03 SUBSURFACE CONDITIONS AND OTHER PHYSICAL CONDITIONS

A. This Section identifies reports of explorations and tests of subsurface conditions, and drawings of physical conditions of existing surface and subsurface structures that have been used in the preparation of the Contract Documents. Contractor may rely upon any technical information and data in those reports that are designated as Authorized Technical Data, but those reports and drawings are not part of the Contract Documents.

B. Any conclusions or interpretations made by the Contractor based on any Authorized Technical Data will be at the Contractor's own risk. Contractor's reliance on any non-technical information, data, interpretations or opinions also will also be at Contractor's own risk. The County/Professional assume no responsibility for any understanding reached or representation made about subsurface conditions and physical conditions of existing structures, except as otherwise expressly shown in or represented by the Authorized Technical Data provided.

C. The only information or data contained in the geotechnical report and used in the preparation of the Contract Documents that may be properly considered authorized technical data concerning subsurface conditions is found in **Appendix 2** "Geotechnical Reports". Such technical data are made available to allow the Contractor to have access to the same information available to the County. The County/Professional does not warrant the accuracy or completeness of any such information or that the Contract Documents identify all the existing relevant reports

and/or documents.

1.04 UNDERGROUND UTILITIES

A. Information or data about physical conditions of Underground Utilities, which have been used in the preparation of the Contract Documents, is shown or indicated in the Drawings and technical specifications. Such information and data is based on information and data obtained from record documents or furnished to the County by the owners of those Underground Utilities or by others.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXISTING GROUND SURFACE AND UNDERGROUND CONDITIONS; GENERALLY

A. Where existing ground conditions are shown on the plans hereto attached, the elevations are believed to be reasonably correct but are not guaranteed to be absolutely so, and, together with any schedule of quantities, are presented only as an approximation. The Contractor shall satisfy itself, however, by actual examination of the site of the Work, as to the existing elevations and the amount of work required under the Contract.

B. Where test pits and borings have been dug, the results supplied to the County/Professional by the Geotechnical Engineer may be given on the plans or are on file in the County/Professional's office and available for review . The County does not guarantee the accuracy or correctness of this information. If the Contractor desires any additional information relating to the soils investigation, contact the County/Professional to obtain such information. County does not guarantee the accuracy or correctness of any such information supplied to the Contractor.

C. If, upon notice of a differing subsurface or latent physical condition from the Contractor, the County determines there was no unforeseen condition and unnecessary tests and investigations were conducted solely at the Contractor's request, any unnecessary expenses may be deducted from the Final Payment for the Contract. No increase in Contract Amount or Contract Time will be made if the differing site conditions were known or could have been discovered by the types of examinations that the Contractor, as Bidder, was responsible for. Claims based on groundwater table conditions will not be considered unforeseen subsurface conditions and will not be allowed. Any information indicated in the Contract Documents as to the groundwater table conditions has been provided for general information purposes only and is not intended to represent that the same conditions will exist during the execution of the Work. Further, no increase in Contract Amount or Contract Time will be made for costs incurred prior to the Contractor's written notice as required by the Contract Documents. The County will be allowed at least ten (10) days to investigate any alleged differing site conditions and to take appropriate action, before the Contractor is entitled to any adjustment in Contract Amount or Contract Time for Delay.

3.02 UNDERGROUND UTILITIES

A. The Contractor will be responsible for the safety and protection of, and providing for the repair of any damage done to the Work and existing surface and subsurface structures. The Contractor will be responsible for any damages and injury resulting from the failure to excavate in a careful and prudent manner.

B. Contractor shall have full responsibility for locating all underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems, shown or indicated in the Contract Documents, in advance of construction, coordinating the Work with the actual locations found and making note of the actual locations on the record Drawings. Contractor shall exercise extreme caution when locating underground facilities to minimize the risk of damage from Contractor's activities. The Contractor will immediately notify the County and the owner of any Underground Utilities that are inaccurately identified or located on the Drawings.

C. The Contractor will be responsible for any delay and all costs relating to the obligations set forth in this Section, except as provided by allowances specific to Underground Utilities.

D. The Contractor will promptly notify the County, in writing, whenever the Contractor discovers that actual physical conditions of Underground Utilities differ materially from those indicated by the Contract Documents or Authorized Technical Data provided with the Contract Documents. Further, the Contractor promptly will notify the County, in writing, whenever the Contractor encounters Underground Utilities not shown or indicated in/through the Contract Documents, and which could not reasonably have been foreseen.

E. The County and Contractor will follow the provisions of the General Conditions with respect to any conclusions reached by the County after the County compares the actual underground utility conditions with those included in the information provided to the Contractor.

3.03 ENVIRONMENTAL PROCEDURES FOR HAZARDOUS MATERIALS

A. The Contractor will not, at any time, cause or permit any Hazardous Materials to be brought upon, stored, manufactured, blended, handled, or used in, on, or about the Project or the Site for any purpose except as lawful and necessary and in accordance with the Contract Documents. The Contractor will not cause or permit Hazardous Materials to be brought on Site unless they have been specifically pre-identified by the Contractor, and approved in writing in advance by the County.

B. The Contractor will defend, save, indemnify and hold harmless the County, their agents and employees from and against all liabilities, claims, damages, losses and expenses including attorney's fees, which arise at any time during or after completion of the Work as a result of or in connection with:

1. The Contractor's breach of any prohibition or requirement set forth in this Section, or
2. Any Hazardous Materials discharged, released, deposited or introduced in the soil or surface or groundwater in, on, under, or about the Work, the Site or other properties as a result of the activities of the Contractor, the Subcontractors and their respective agents and employees in connection with the Work.

C. This Contractor's indemnity obligation includes without limitation, costs incurred in connection with any investigation of site conditions or any cleanup, remediation, removal, or restoration required by the County or any federal, State, or local Public Agency because of:

1. The occurrence of any Hazardous Materials present in the soil or surface or groundwater in, on, under, or about the Work or the Site;
2. The diminution in value of the Work or the Site;
3. Damages for the loss or restriction on use of the Work or of any amenity of the Work or the Property; and/or
4. Amounts paid in settlement of claims, penalties, attorneys' fees, court costs, consultant and laboratory fees and experts' fees.

D. The Contractor will immediately notify the County in writing of any significant release of Hazardous Materials at the Project or the Site, specifying the nature and quantity of the release, the location of the release, and the measures taken to contain and clean up the release and ensure that future releases do not occur.

E. The Contractor agrees that insulation and any other construction materials containing asbestos or urea formaldehyde will not be used on the Work, and that all Sub-agreements will prohibit the use of construction materials (including, but not limited to, insulation) containing asbestos or urea formaldehyde.

3.04 DIFFERING HAZARDOUS MATERIAL CONDITIONS:

A. If the Contractor unexpectedly encounters material reasonably believed to be Hazardous Material, the Contractor will immediately stop all affected Work, give written notice to the County and take appropriate health and safety precautions. Unless the Contract Documents require otherwise, the Contractor will conduct an investigation. If upon due investigation, the Contractor determines the material a Hazardous Material that may present a danger to persons or the surroundings, the Contractor will recommend a solution to the County. In any such case, the affected Work will be considered to have been under a suspension of Work.

B. If the Hazardous Material is not required Work under the Drawings and/or Specifications, the County will proceed to have the Hazardous Material removed or rendered harmless through a Change Order or by means of another contract or as the County otherwise deems expedient. Alternatively, the County will terminate the affected Work or Contract for the County's convenience.

C. If the County did not elect termination, once the Hazardous Material has been removed or rendered harmless, the affected Work will be resumed as directed in writing by the County. Any determination by the Florida Department of Community Health or the Department of Environmental Quality that the Hazardous Material has been removed or rendered harmless will be binding upon the County and Contractor for the purposes of resuming the affected Work.

D. If the Contractor is responsible for the Hazardous Material, the Contractor will bear its proportionate share of the delay and costs involved in cleaning up the Site and removing and rendering it harmless to the satisfaction of the County and all Political Subdivisions with jurisdiction. The Contractor will be solely responsible if the Hazardous Material was brought to the Site by the Contractor, or results in whole or in part from any violation by the Contractor of any applicable Laws.

E. If the Contractor is responsible, but fails to take appropriate action, and the County acts accordingly, the Contractor will defend, save, indemnify and hold harmless the County from and against all claims arising from the County's exercise of appropriate action.

F. If the Contractor is not responsible, the County will issue a Change Order with the necessary changes. The Change Order will adjust Contract Amount and/or Contract Time as made necessary by the changes and resulting unreasonable delay under the circumstances attributable to the County /Professional.

3.05 INCIDENTS WITH ARCHAEOLOGICAL FEATURES:

A. The Contractor will immediately notify in writing the County and all Federal, State and local agencies with jurisdiction of any Archaeological Feature deposits encountered or unearthed. The Contractor will protect such Archaeological Features in a proper and satisfactory manner. No further disturbance of the Archaeological Features will take place until work is allowed to resume in the affected areas.

B. If the County concludes that the Contract Documents require changes because of Archaeological Feature deposits encountered, the County will issue a Change Order with the necessary changes in the Work. The Change Order also will adjust Contract Amount and/or Contract Time as made necessary by those changes and by any resulting unreasonable delay under the circumstances attributable to the County/Professional.

END OF SECTION

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SECTION 01026

MEASUREMENT AND PAYMENT

SECTION 1.01 PART 1 GENERAL

1.01 SECTION INCLUDES

Measurement and payment provisions for Lump Sum Projects, Schedule of Values.

1.02 GENERAL MEASUREMENT AND PAYMENT PROVISIONS

A. Payment for all work done in compliance with the Contract Documents, inclusive of furnishing all manpower, equipment, materials, and performance of all operations relative to construction of this project, will be made as a lump sum which will be complete payment for all work called for or reasonably inferable from the Contract Documents and other work will be considered incidental to the Contract and no additional compensation will be allowed.

B. The County reserves the right to alter the Drawings, modify incidental work as may be necessary, and increase or decrease the work to be performed to accord with such changes, including deductions or additions to the scope of work outlined in the Contract Documents. Changes in the work shall not be considered as a waiver of any conditions of the Contract nor invalidate any provisions thereof. Changes resulting in changes in the scope or quantities of Work or time or other conditions of work will be basis for consideration of a Change Order which is to be negotiated and executed before proceeding with the work. A supplemental agreement between the Contractor and the Owner will be required when such changes meet the conditions described in the Supplementary Conditions. Work which has not been authorized by a written Change Order will not be subsequently considered for additional payment.

C. The Contractor shall take no advantage of any apparent error or omission in the Drawings or Specifications, and the County shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.

D. Failure on the part of the Contractor to construct any item to plan or authorized dimensions within the specification tolerances shall result in: reconstruction to acceptable tolerances at no additional cost to the County; acceptance at no pay; or, acceptance at reduced price, all at the discretion of the County.

E. Work shall not be considered complete until all testing has been satisfactorily completed and the item of work has demonstrated compliance with plans and specifications.

F. A preliminary monthly application for payment shall be submitted to the Owner/Engineer for review five (5) days prior to the submittal for approval of the Contractor's monthly payment request.

1.03 SCHEDULE OF VALUES

A. Submit Schedule of Values for approval prior to commencing construction. As a minimum, include those items called for in Section 01370 "Schedule of Values". The Schedule of Values shall be the basis for making payment applications and establishing prices for Change Orders.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 – GENERAL

1.01 REQUIREMENT

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Prior to submitting a monthly payment application, the Contractor's progressive As-Built Drawings and As-Built Asset Attribute Data, and Pipe Deflection Tables shall be accepted by the County.

C. Progressive As-Built Drawings shall indicate the horizontal and vertical locations of all current constructed improvements with sufficient information and notes to easily determine if the improvements were constructed in conformance with the Contract Documents. The progressive As-Built Asset Attribute Data, and Pipe Deflection Tables shall include a Surveyor's certified statement regarding the constructed improvements being within the specified accuracies or if not, indicating the variances as described in specification Section 01050 "Surveying and Field Engineering", Table 01050-1 Minimum Survey Accuracies.

1.02 FORMAT

A. Format and Content: Use the accepted Schedule of Values.
   1. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
      a. Generic name
      b. Related specification section
      c. Name of subcontractor
      d. Name of manufacturer or fabricator
      e. Name of supplier
      f. Dollar value
   2. Round amounts off to the nearest whole dollar. The total shall equal the Contract Amount.

1.03 PREPARATION OF APPLICATION

A. Each Application for Payment shall be consistent with previous applications and payments as certified and paid for by the County.
   1. The initial Application for Payment: The Application for Payment at time of Substantial Completion and the final Application for Payment involve additional requirements.

B. Payment Application Times: As stated in the General Conditions, Payment applications are to be submitted monthly on a day of the month to be established by the County at the Pre-Construction conference.

C. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.
   1. Submit applications typed on forms provided by the County.
   2. Use data on Bid Form and approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
   3. List each authorized Change Order and an extension or continuation sheet, listing Change Order number and dollar amount as for an original item of work.
   4. Each item shall have an assigned dollar value for the current pay period and a cumulative value for the project to-date.
   5. Submit stored material log, partial waivers of claims and mechanic liens, and consent of surety with each application, as further explained below.

D. Submit a stored material log with each application for payment which identifies the type, quantity and value of all stored material, and that tracks when the stored materials are installed and deducts them from stored quantity at that time. Include original invoices for all stored materials that payment is requested.

E. Waivers of Claims and Mechanics Lien: With each Application for Payment submit waivers of claims and mechanics liens from Subcontractors or Sub-subcontractors and suppliers for the construction period covered by the previous applications.
   1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. The County reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of work covered by the application who could lawfully be entitled to a payment claim or lien.
   5. Waiver Forms: Submit waivers of claims and lien on forms and executed in a manner acceptable to the County.

F. Transmittal: Submit 4 executed copies of each Application for Payment to the County by means ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments when required.
   1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the County.
   2. The Contractor shall include a certification with each application stating that all previous payments received from the County under the Contract have been applied by the Contractor to discharge in full all obligations of the Contractor in connection with the Work by prior applications for payment, and all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest and encumbrances.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the

following:

1. List of Subcontractors
2. List of principal suppliers and fabricators
3. Schedule of Values
4. Contractor's Construction Progress Schedule (accepted)
5. List of Contractor's staff assignments
6. Copies of building permits
7. Copies of authorizations and licenses from governing authorities for performance of the Work.
8. Certificates of insurance and insurance polices
9. Performance and Payment bonds (if required).
10. Data needed to acquire County's insurance.

H Monthly Application for Partial Payment: Administrative actions and submittals that must precede or coincide with submittal of Monthly Partial Payments include the following:

1. Relevant tests
2. Progressive As-builts
3. Table 01050-2 Asset Attribute Data Form Examples
4. Table 01050-3 Pipe Deflection Table Example
5. Table 01050-4 Gravity Main Table
6. Partial Release of lien
7. Partial consent of surety
8. Site photographs
9. Updated Progress Schedule: submit one electronic copy and five (5) copies
10. Summary of Values
11. Pay Request
12. On-Site Storage

I. Substantial Completion Application for Payment: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment. This application shall reflect any Certificates of Partial Substantial Completion issued previously for County occupancy of designated portions of the Work.

1. Administrative actions and submittals that shall precede or coincide with this application include:
    a. Occupancy permits and similar approvals
    b. Warranties (guarantees) and maintenance agreements
    c. Test/adjust/balance records
    d. Maintenance instructions
    e. Meter readings
    f. Start-up performance reports
    g. Change-over information related to the County's occupancy, use, operation and maintenance
    h. Final Cleaning
    i. Application for reduction of retainage and consent of surety.
    j. Advice on shifting insurance coverage
    k. List of incomplete work, recognized as exceptions to County’s Certificate of Substantial Completion

J. Final Completion Application for Payment: Administrative actions and submittals

which must precede or coincide with submittal of the final payment Application for Payment include the following:

1. Prior to submitting a request for final payment or the County issuing a Certificate of Completion for the Work, the Contractor shall submit the final Record Documents to the County for approval. Retainage funds will be withheld at the County's discretion based on the quality and accuracy of the final Record Documents
2. Completion of project close-out requirements.
3. Completion of items specified for completion after Substantial Completion
4. Assurance that unsettled claims are settled
5. Assurance that work not complete and accepted is now completed.
6. Transmittal of required project construction records to the County.
7. Proof that taxes, fees and similar obligations have been paid.
8. Removal of temporary facilities and services has been completed.
9. Removal of surplus materials, rubbish and similar elements.
10. Change of door locks to County's access.
11. Execute certification by signature of authorized officer.
12. Prepare Application for Final Payment as required in General Conditions.

1.04 SUBMITTAL PROCEDURES

A. Submit four (4) copies of each Application for Payment at time stipulated in Agreement.

B. Submit under transmittal letter.

1.05 SUBSTANTIATING DATA

A. When the County requires substantiating information, submit data justifying line item amounts in question.

B. Provide one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01050

SURVEYING AND FIELD ENGINEERING

PART 1 –GENERAL

1.01 DESCRIPTION

A. Professional Surveyor: Provide professional surveying and mapping work required for the execution of the contract, including verification of existing survey data, construction layout, and production of the As-Built Drawings. This Work shall be performed by a Surveyor that is licensed by the State of Florida as a professional surveyor and mapper pursuant to Chapter 472, F.S.

B. Professional Engineer: The Contractor shall provide the services of a Registered Professional Engineer currently licensed in the State of Florida for the following specific services as applicable to the Work.

1.02 REQUIREMENTS

A. Survey Control
   1. The Contractor shall retain the services of a registered Surveyor and Mapper licensed in the State of Florida to provide professional surveying and mapping services, and maintain both a control survey and an as-built survey during Construction. Project construction layout shall be established from the existing reference points shown on the construction Drawings. The method of field staking for the construction of the Work shall be at the option of Contractor. A copy of all field notes shall be submitted with the pay request, to the County through the Contractor. The accuracy of any method of staking shall be the responsibility of Contractor. All engineering, for vertical and horizontal control, shall be the responsibility of Contractor. All staking shall be done to provide for easy verification of the work by the County.

B. Engineering Services
   1. The Engineer shall be responsible for duties during Construction to include, but not limited to:
      a. Inspections, testing, witnessing requiring a licensed Professional Engineer.
      b. Design of temporary shoring, bridging, scaffolding or other temporary construction, formwork and protection of existing structures.
      c. Other requirements as specified herein.
   2. Engineering related designs, tests and inspections shall be signed by the licensed Professional Engineer as required by the County.

C. The site survey will identify control points (monuments and bench marks noted on the Drawings). The Contractor shall confirm and accept the control points. The Contractor shall provide all other surveys necessary for the Construction of the Project.

1.03 QUALIFICATIONS OF THE SURVEYOR

A. The Surveyor, who is proposed by the Contractor to provide services for the Project, is subject to the approval of the County. Prior to any services being performed, the Contractor shall submit the name and address of any proposed Surveyor and a written acknowledgement

from the Surveyor stating that he has the hardware, software and adequate scope of services in his agreement with the Contractor to fully comply with the requirements of this specification. These submittals shall be provided to the County prior to Notice to Proceed. It is recommended that the Surveyor attend the Pre-Construction meeting. Any Surveyor, who has not previously performed work for the County shall attend the Pre-Construction meeting.

1.04 SUBMITTALS

A. Provide qualifications of the Surveyor or Engineer.
   1. A Florida Registered Professional Engineer or Registered Surveyor and Mapper, who is proposed by the Contractor to provide services to the Project shall be acceptable to the County prior to field services being performed.
   2. A Professional Engineer shall be of the discipline required for the specific service on the Project.
   3. Submit name, address and telephone number of the Surveyor and/or Engineer, as appropriate to the County for acceptance before starting survey or engineering work.

B. On request, submit documentation verifying accuracy of survey work.

C. Surveyor shall certify all elevations and locations included in Table 01050-1, 2, 3, and 4.

PART 2 – PRODUCTS

2.01 SURVEY DOCUMENTS

A. Survey documents shall comply with the minimum technical standards of Chapter 61G17-6 of the Florida Administrative Code (FAC) and Table 01050-1 Minimum Survey Accuracies, whichever are more stringent. The Tables 01050-2, 01050-3, and 01050-4 shall be signed, sealed and dated by the Surveyor with each pay request. All coordinates shall be geographically registered in the Florida State Plan Coordinate System using the contract Drawings control points for horizontal and vertical controls.

Table 01050-1
Minimum Survey Accuracies

Asset	Horizontal Accuracy (feet)	Elevation Accuracy (feet)	Location: Horizontal Center and Vertical Top, unless otherwise specified
Bench Marks	0.01	0.01	Point
Baseline Control Locational Accuracy	0.01	N/A	Point
Tract and Easement Corners	*	N/A	Survey Monuments
Mains at 100’ max. intervals	0.1	0.1	Pipe, Pipe at Valves, Pipe at Bore & Jack Casing
PVC pipe >16-inch at every pipe joint	0.1	0.1	Pipe, Pipe at Valves, Pipe at Bore & Jack Casing
Fittings, Sleeve, Tapping Saddle, and end of the pipe if Plugged or Capped.	0.1	0.1	Fitting
Restrained Pipe	0.1	N/A	Restrained Joint Limits
Connections	0.1	0.1	Pipe
Bore & Jack Casing	0.1	0.1	Top of Casing at the Casing Limits
Directional Drill	0.1	0.1	10ft intervals during the directional drill operation
Hydrants	0.1	N/A	Operating Nut of Hydrant
Valves	0.1	0.1	Operating Nut
Air Release, Blow off, and Backflow Valves	0.1	N/A	Valve Enclosure
Master Meters, Deduct Meters & Wastewater Meters	0.1	N/A	Register
Meter Box	0.1	N/A	Meter Box
Clean out	0.1	N/A	Clean out
Manhole Rim	0.1	0.1	Manhole
Manhole Inverts	N/A	0.01	Pipe Inverts
Pump Station (Public & Private)	0.1	0.01	Wet Well and Pipe Inverts
Production Well or Monitoring Well	0.1	0.1	Well
Grease Interceptor	0.1	0.1	
Oil / Water Separators	0.1	0.1	
Demolished Pipe (abandoned in place or removed)	0.1	0.1	Limits of Abandoned or Removed Pipe
Existing Utilities water, wastewater, reclaimed water, and appurtenant structures **	0.1	0.1	Pipe or Structure

* Shall conform to the requirements of the "Chapter 5J-17, ‘Minimum Technical Standards’, FAC", certified by a SURVEYOR.

** Existing utilities including but not limited to water, wastewater, reclaimed water, storm, fiber optic cable, electric, gas and structures within the limits of construction.

TABLE 01050-2
Asset Attribute Data Form Examples

Hydrants Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H	I
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Manufacturer	Model #	Comments
2	FH-1	C-7	518456.40	1483743.63	49.53	Brand B	XJ7-B	
3	FH-2	C-9	518477.68	1483758.95	54.23	Brand B	XJ7-B	

General Info | Hydrant | Valve | Manhole | Meter | Fitting | Cleanout | Pip

Valves Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H	I	J
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Valve Type	Main Type	Valve Size	Valve Manufacture
2	ARV-1	C301	518060.09	1483231.33	81.72	ARV - Combination	Water Main	2	Brand H
3	ARV-1	C303	518083.55	1483280.50	81.15	ARV - Vacuum	Force Main	4	Brand G
4	BFP-1	C303	518086.00	1483282.88	78.21	Backflow Preventer	Reclaimed Water Main	8	Brand F
5	BO-9	C405	518088.83	1483289.43	78.20	Blowoff	Water Main	2	Brand E
6	BFV-1	C405	518088.11	1483295.00	81.95	Butterfly	Water Main	30	Brand D
7	GV-3	C405	518132.54	1483372.75	81.23	Gate	Water Main	16	Brand C
8	LS-W1	C405	576779.36	1539706.97	64.30	Line Stop	Water Main	16	Brand B
9	PV-22	C405	576880.60	1539718.32	64.52	Plug	Force Main	12	Brand A

General Info | Hydrant | Valve | Manhole | Meter | Fitting | Cleanout | Pipe | Pumpstation | Well

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	J	K	L	M	N	O	P	Q
1	Valve Manufacturer	Valve Model #	# of Turns to Close	Gear Actuator	Gear Ratio	Side Actuator	uator Manufacti	Comments
2	Brand H	100XT						
3	Brand G	1000						
4	Brand F	2000 fgs						
5	Brand E	14 turbo						
6	Brand D	230 xls	200	Yes	3 to 1	Yes	Brand C	
7	Brand C	2225846	300	Yes	3 to 1	NO		
8	Brand B	7n6r44						
9	Brand A	Z100	200	Yes	3 to 1	Yes	Brand A	

General Info | Hydrant | Valve | Manhole | Meter | Fitting | Cleanout | Pipe | Pumpstation | Well

Manhole Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H	I	J	K	L	M	N	O
1	ID Number	Plan Sheet #	Easting	Northing	Rim Elevation	Invert Elv N	Invert Elv NE	Invert Elv E	Invert Elv SE	Invert Elv S	Invert Elv SW	Invert Elv W	Invert Elv NW	Manufacturer
2	MH-1	C-20	517999.15	1483092.24	82.96	76.96		76.96		76.91				Brand X
3	MH-2	C-20	517999.15	1483492.24	83.54	75.63				75.58				Brand X

Manhole | Meter | Fitting | Cleanout | Pipe | Pumpstation | Well | Property or Easement Corner | Existing OC Utility

Meter Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Main Type	Comments
2	MM-1	C-6	576533.64	1539520.08	58.01	Water Main	
3	RWMM-1	C-6	576937.42	1539598.78	64.84	Reclaimed Water Main	

General Info | Hydrant | Valve | Manhole | Meter | Fitting | Cleanout

Fitting Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H	I
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Main Type	Fitting Type	Comments
2	FM-1	C-3	572399.28	1539339.13	46.27	Force Main	Bend 11 1/4°	
3	FM-2	C-3	574840.74	1539856.91	51.73	Force Main	Bend 22-1/2°	
4	FM-3	C-3	574844.01	1539856.71	52.48	Force Main	Bend 45°	
5	FM-4	C-3	574845.72	1539856.61	52.33	Water Main	Bend 90°	
6	FM-5	C-3	574845.85	1539858.77	51.98	Water Main	Cap	
7	RW-1	C-4	574884.06	1539849.64	51.75	Reclaimed Water Mai	Cross	
8	RW-2	C-4	574887.22	1539849.56	48.98	Reclaimed Water Mai	Reducer	
9	RW-3	C-4	574904.30	1539849.10	49.39	Reclaimed Water Mai	Plug	
10	RW-4	C-4	574907.42	1539849.01	52.32	Reclaimed Water Mai	Sleeve	
11	WM-1	C-5	574938.65	1539848.16	54.42	Water Main	Tapping Saddle	
12	WM-2	C-5	572532.38	1539337.10	45.27	Water Main	Tee	
13	WM-3	C-5	572631.00	1539338.00	44.13	Water Main	Wye	
14	WM-4	C-5	572731.00	1539334.00	43.77	Water Main	Tapping Sleeve	

General Info | Hydrant | Valve | Manhole | Meter | **Fitting** | Cleanout | Pipe | Pum

Cleanout Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Comments
2	CO-1	C-6	576533.64	1539520.08	58.01	
3	CO-2	C-6	576937.42	1539598.78	64.84	

Fitting | **Cleanout** | Pipe | Pumpstation | Well | Pr

Pipes Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H	I	J	K	L	
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Main Type	Type of Shot	nstruction Meth	Material	Pressure Class	Manufacturer	Co
2	CSNG-1	C-4	517827.57	1482195.46	78.83	Force Main	Bore & Jack (Casing)		PVC	DR18	Brand A	
3	CSNG-2	C-4	517848.20	1482195.31	78.38	Force Main	Bore & Jack (Casing)		PVC	DR18	Brand A	
4	RW-1	C-7	517731.98	1482237.24	80.42	Reclaimed Water Mair	Restraint Joint Limit	Open Cut	DIP	Class 250	Brand B	
5	RW-2	C-7	517732.848	1482338.1	80.943	Reclaimed Water Mair	Restraint Joint Limit	Open Cut	DIP	Class 250	Brand B	
6	WM-1	C-9	573309.068	1539372.9	56.10	Water main	Shot on Pipe	Open Cut	PVC	DR18	Brand C	
7	WM-2	C-9	573308.752	1539375	54.66	Water main	Shot on Pipe	Open Cut	PVC	DR18	Brand C	
8	FMDD-1	C-4	504345.94	1488969.2	114.14	Force Main	Shot on Pipe	Directional Drill	HDPE	DR17	Brand X	
9	FMDD-2	C-4	504360.86	1488970.5	112.74	Force Main	Shot on Pipe	Directional Drill	HDPE	DR17	Brand X	
10	FMDD-3	C-4	504377.19	1488971.2	106.14	Force Main	Shot on Pipe	Directional Drill	HDPE	DR17	Brand X	
11	FM-9	C-4	504480.47	1488982.9	105.24	Force Main	Shot on Pipe	Open Cut	PVC	DR18	Brand C	

General Info | Hydrant | Valve | Manhole | Meter | Fitting | Cleanout | **Pipe** | Pumpstation | We

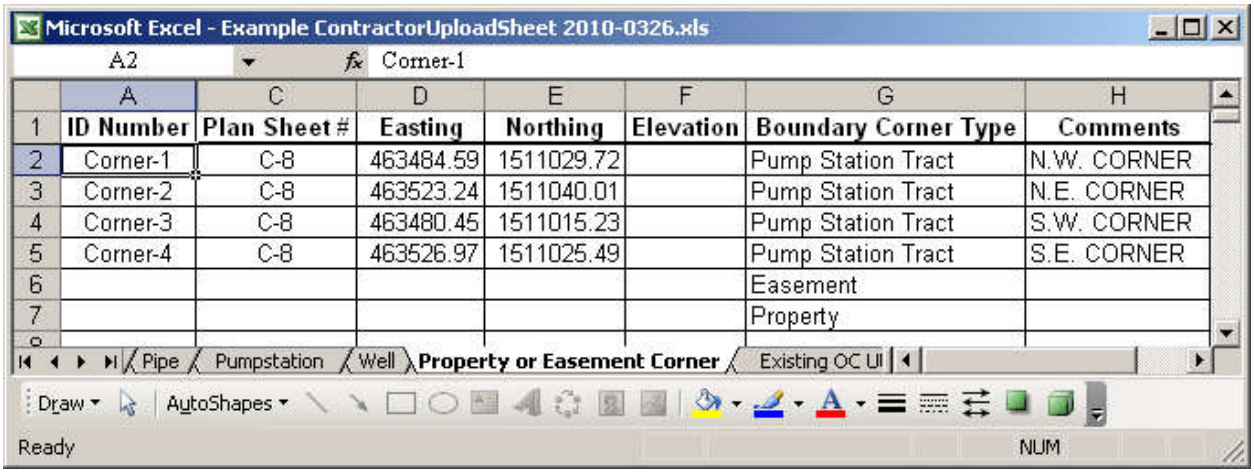
Pump Station Worksheet

Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Comments
2	PS-1	C-40	517914.346	1482906.562	83.912	

Fitting | Cleanout | Pipe | **Pumpstation** | Well | Prope

Easements Worksheet



Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

A2 | Corner-1

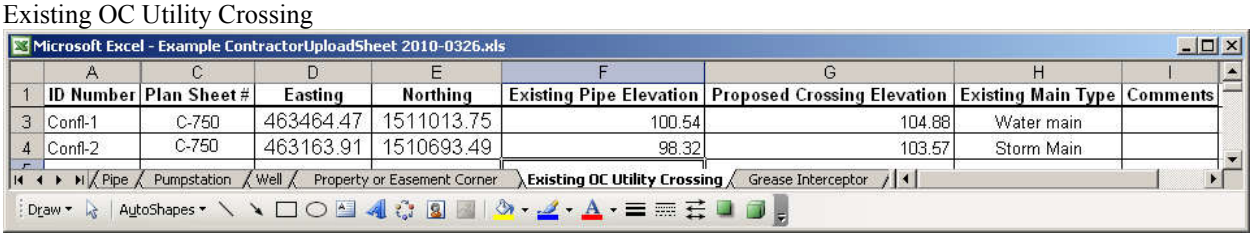
	A	C	D	E	F	G	H
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Boundary Corner Type	Comments
2	Corner-1	C-8	463484.59	1511029.72		Pump Station Tract	N.W. CORNER
3	Corner-2	C-8	463523.24	1511040.01		Pump Station Tract	N.E. CORNER
4	Corner-3	C-8	463480.45	1511015.23		Pump Station Tract	S.W. CORNER
5	Corner-4	C-8	463526.97	1511025.49		Pump Station Tract	S.E. CORNER
6						Easement	
7						Property	

Pipe | Pumpstation | Well | Property or Easement Corner | Existing OC Ut

Draw | AutoShapes

Ready NUM

Existing OC Utility Crossing



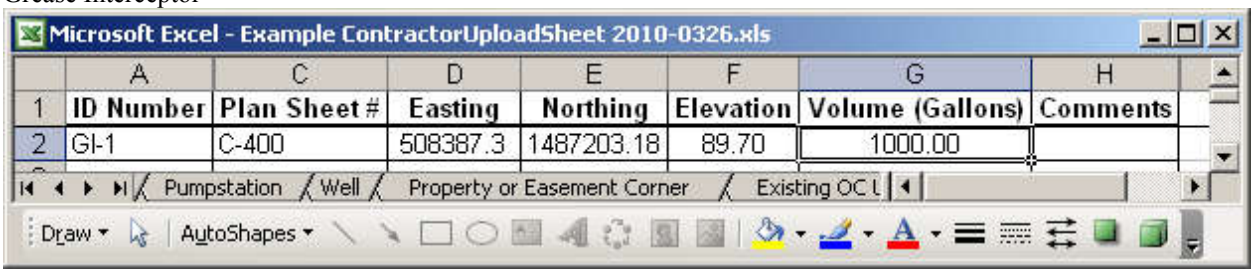
Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H	I
1	ID Number	Plan Sheet #	Easting	Northing	Existing Pipe Elevation	Proposed Crossing Elevation	Existing Main Type	Comments
3	Confl-1	C-750	463464.47	1511013.75	100.54	104.88	Water main	
4	Confl-2	C-750	463163.91	1510693.49	98.32	103.57	Storm Main	

Pipe | Pumpstation | Well | Property or Easement Corner | Existing OC Utility Crossing | Grease Interceptor

Draw | AutoShapes

Grease Interceptor



Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	A	C	D	E	F	G	H
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Volume (Gallons)	Comments
2	GI-1	C-400	508387.3	1487203.18	89.70	1000.00	

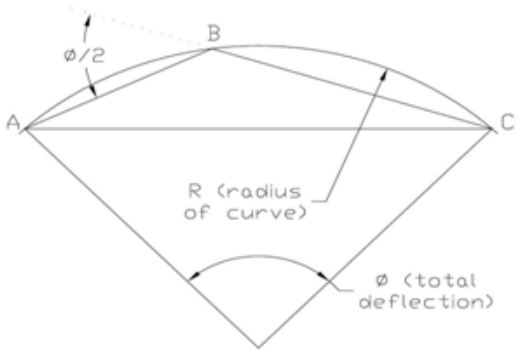
Pumpstation | Well | Property or Easement Corner | Existing OC L

Draw | AutoShapes

For ease of calculating pipe deflections in Table 01050-3, begin by providing a unique asset ID (top of pipe shots and fittings) for each utility and type, numbered sequentially along the pipe run (including changes in direction) from start to finish of the pipe in the Table 01050-2. Then branches and services of the same utility type can be numbered. It is recommended that each utility (water, wastewater or reclaimed water) numbering format be distinguishable from the other. This will allow organization and convenient sorting after the individual asset table worksheet tabs are combined in the spreadsheet program prior to copying and pasting to the deflection table spreadsheet.

TABLE 01050-3
PIPE DEFLECTION TABLE EXAMPLE

Project:			
Contractor:			
Progress Mtg Date:			
Contract #			
Dwg Sheet #			
Utility Type		FM	
Pipe Manufacturer		National Pipe	
Pipe size & material		16" PVC C905	
PVC Manufacturer Deflection		6	inches
County Allowable Deflection	75%	4.5	inches
Allowable Angle of Offset		1.5	degrees
Allowable Radius of Curvature		764	feet
Laying Length of Pipe		20	feet



ID	Size and Type	Northing	Easting	Elev.	Calculations Including Elevation (XYZ)						
					Distance between points AB	Distance between points BC	Distance between points AC	Total Deflection Ø*	Radius of Curve**	Average Offset Angle***	Average Offset****
					Length AB	Length BC	Length AC	XYZ (w/ elevation)	XYZ (w/ elevation)	per laying length	per laying length
					ft	ft	ft	degrees	ft	degrees	inches
14041	16" FM	1505131.50	468948.53	107.68	-	-	-	-	-	-	-
7000	16" FM	1505059.60	468932.08	108.15	73.76	38.93	112.66	5.48	1,178.35	0.97	4.07
2128	16" FM	1505022.11	468921.60	108.55	38.93	39.61	78.54	2.29	1,961.65	0.58	2.45
2127	16" FM	1504983.85	468911.35	108.29	39.61	38.35	77.96	1.78	2,505.50	0.46	1.92
2126	16" FM	1504946.67	468901.96	107.81	38.35	39.13	77.42	8.79	505.16	2.27	9.51
2125	16" FM	1504908.11	468895.31	107.48							

Data that has be inputted

Values in yelloware over spec

*Uses lawof cosines to determine angle ABC and Ø.
angle ABC = arccos((AB²+BC²-AC²)/(2*AB*BC))
180-Ø/2 = angle ABC
Calculate the total deflection Ø.
to the outer point (A or C) is equal in angle to
the approach from the next point along the

** Uses lawof sines, using the chord length AC and radius R.
Since sin((Ø/2)*(PI/180))=(Chord/2)/R and length AC=Chord
R=AC/(2*sin(Ø*PI/360)
This calculation assumes an average radius over the bend between three points.

*** Adds the lengths of AB + BC /20ft to get an approximate number of bends over the span.
This value is divided by the total deflection
angle to calculate the average bend angle of
This assumes that the bend angle consistent across the entire length.

**** Uses average offset angle and laying length of pipe.

Table 01050-4
Gravity Main Table

Downstream		Upstream		Length (ft)	Design Slope	Constructed Slope	Constructed Allowable Slope
Manhole Number	Invert Elev.	Manhole Number	Invert Elev.				

PART 3 – EXECUTION

3.01 SURVEY FIELD WORK

A. Locate, reference, and preserve existing horizontal and vertical control points and property corners shown on the Drawings prior to starting any construction Work. If the Surveyor performing the Work discovers any discrepancies that will affect the Project, the Contractor must immediately report these findings to the County. All survey Work shall meet the requirements as defined in Florida Administrative Code 61G17-6. Reference and preserve all survey points during Construction. If survey points are disturbed, it is the responsibility of the Contractor's Surveyor to reset the points at the Contractor's expense. Copies of the Surveyor's field notes and/or electronic files for point replacement shall be provided to the County.
   1. The Surveyor shall locate all improvements for the project As-Built Asset Attribute Data using State Plane Coordinates as the horizontal datum and the benchmark referenced on the Drawings as the vertical datum. The County will provide electronic files of the Drawings to be used by the Surveyor in complying with these specifications.
   2. The construction layout shall be established from the reference points shown or listed on the Drawings. The accuracy of any method of staking shall be the responsibility of the Contractor. All construction layout staking shall be done such as to provide for easy verification of the Work by the County.

B. Only a Surveyor licensed in the State of Florida shall be employed for this Work. All control points shall be protected by the Contractor from disturbance. If the monuments are disturbed, any Work that is governed by these monuments shall be held in abeyance until the monuments are reestablished by the Contractor and approved by the County. The accuracy of all the Contractor's stakes, alignments and grades is the responsibility of the Contractor. However, the County has the discretionary right to check the Contractor's stakes, alignments, and grades at any time.

C. Use survey control points to layout such work tasks including but not limited to:
   1. Clearing, grubbing, work limits, right-of-way lines and easements
   2. Locations for pipelines and all associated structures and appurtenances

D. The Surveyor shall reference and replace any project control points, boundary corners, benchmarks, section corners, and right-of-way monuments that may be lost or destroyed, at no additional cost to the County. Establish replacement points based on the original survey control. Copies of all reference field notes and/or electronic files for point replacement shall be submitted to the County.

3.02 SURVEYING

A. Locate and protect existing horizontal and vertical control points shown on the construction Drawings prior to starting any work. If the Surveyor performing the Work finds differences that will effect the Work, the Contractor must immediately report the findings to the County. Establish control points, lines and levels by instrumentation and similar appropriate means. The location of these points should minimize the number of sightings necessary to control the work and the likelihood of the points being disturbed. Preserve and reference all permanent reference points during Construction. If permanent reference points are disturbed, it is the responsibility of the Contractor's Surveyor to reset the points at the Contractor's

expense. Copies of the Surveyor's field notes shall be provided to the County.

1. Record locations, with horizontal and vertical data, on project As-Built survey.
2. Make no changes or relocations without prior written notice to the County or without receipt of written approval from the County.
3. Report to the County when any control point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

B. Cover for water, reclaimed water and force mains shall vary to provide long uniform gradient or slope to pipe to minimize air pockets and air release valves. The locations shown on the Drawings for air and vacuum release valve assemblies are approximate and the Contractor shall field adjust these locations to locate these valves at the highest point in the pipeline installed.

C. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:
   1. Gravity lines: Continuous control, using laser beam technology,
   2. Pressure lines: Control stakes set at 50 ft. intervals using Surveyor's level instrument.

END OF SECTION

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SECTION 01065

PERMITS AND FEES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. General

1. Upon Notice of Award, obtain and pay for all appropriate and applicable permits and licenses as provided for in the General Conditions, except as otherwise provided herein.
2. Schedule all inspections and obtain all written approvals of the agencies required by the permits and licenses.
3. Strictly adhere to the specific requirements of the governmental unit(s) or agency(cies) having jurisdiction over the Work. Whenever there is a difference in the requirements of a jurisdictional body and the Contract Documents, the more stringent shall apply.
4. A copy of the permits obtained by the County are furnished in **Appendix 1** "Permits" of these specifications.
5. Unless otherwise specified, the cost of work specified in the various sections of Division 1, will not be paid for separately but the cost therefore shall be considered incidental to and included in the bid prices of the various Contract items.

B. Building Permit

1. Orange County Utilities will submit and pay for Building Department Permit. The Contractor shall pull permit and schedule all inspections and obtain final approval from the building inspectors.
2. Information on Orange County Building Department fees is included in the Instructions to Bidders in Division 0.
3. The Contractor shall be responsible for scheduling all permit inspections and obtaining inspection approval from Orange County, as required by the building and sub-discipline construction permits.
4. The Contractor will be responsible for applying and paying for all subsequent trade permits.

C. Construction Dewatering Permit (by Contractor)

The Contractor shall apply and pay for all fees associated with obtaining Florida Department of Environmental Protection (FDEP) District Office construction dewatering permits, if required. The Contractor shall provide all materials and equipment to comply with the permit requirements at no additional cost to the County.

D. FDEP construction completion and clearance, 62-555.900(9) (by Orange County)

1. Contractor shall provide pressure tests and bacteriological test results to the County.

2. County shall submit and obtain clearance prior to connecting the new facilities to the exiting PWS transmission system.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01070

ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 REFERENCED STANDARDS

A. Any reference to published specifications or standards of any organization or association shall comply with the requirements of the specification or standard which is current on the date of Advertisement for Bids. In case of conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.

B. In case of conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.

1.02 ABBREVIATIONS

The following is a list of abbreviations, which may be contained herein.

TABLE 01070-1
ABBREVIATIONS

Abbreviation	Definition
AA	Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Ass.
AGA	American Gas Association
AGMA	American Gear Manufacturer's Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	American Moving Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air

TABLE 01070-1
ABBREVIATIONS

Abbreviation	Definition
	Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASTM	American Society for Testing and Materials
AWA	American Welding Society
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWS	American Welding Society
AWWA	American Water Works Association
CFM	Cubic Feet per Minute
CSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
FDOT Index	FDOT Roadway & Traffic Design Standards
FDOT Spec.	Florida Department of Transportation Standard Specification for Road and Bridge Construction, latest revision
FAC	Florida Administrative Code
FS	Federal Standard or Florida Statutes
GPM	Gallons per Minute
HP	Horsepower
ID	Inside Diameter
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
MG	Million Gallons
MGD	Million Gallons per Day
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electric Code
NECA	National Electrical Contractors' Association
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
NPT	National Pipe Threads
NSF	National Science Foundation
OD	Outside Diameter
OOCEA	Orlando Orange County Expressway Authority
OSHA	Occupational Safety and Health Association, U.S. Department of Labor
PCA	Portland Cement Association
PCI	Prestressed Concrete Association
PS	United States Product Standard
PSIG	Pounds per Square Inch Gauge
RPM	Revolutions per Minute

TABLE 01070-1
ABBREVIATIONS

Abbreviation	Definition
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSPC	Structural Steel Painting Council
STA	Station (100')
TDH	Total Dynamic Head
UL	Underwriters' Laboratories, Inc.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF SECTION

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SECTION 01200

PROJECT MEETINGS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor participation in pre-construction conferences, progress meetings and specially called meetings.

1.02 MEETINGS CALLED BY THE COUNTY

A. The County will schedule a pre-construction conference, periodic progress meetings and specific topic meetings throughout the progress of the Work. The County will:
   1. Prepare and distribute a notification of the meeting to required attendees.
   3. Make physical arrangements for the meetings.

B. CPH will administer a pre-construction conference, periodic progress meetings and specific topic meetings throughout the progress of the Work. CPH will:
   1. Establish, prepare and distribute an agenda with the notification.
   2. Preside at meetings
   3. Prepare and distribute minutes of meetings including significant proceedings and decisions, within 15 working days after each meeting. Minutes will be forwarded to all participants and to parties affected by decisions made at the meeting

   Representatives of the Contractor, Subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

   The meeting location will generally be a central site, convenient for all parties, designated by the County.

1.03 PRE-CONSTRUCTION CONFERENCE

A. Attendance:
   1. County
   2. Contractor and superintendent
   3. Subcontractors as appropriate to the agenda
   4. Representatives of suppliers and manufacturers as appropriate to the agenda
   5. County MBE/WBE representative
   6. Other agency representatives (FDEP, EPA, County, etc.)
   7. Others as requested by the County or Contractor

B. Suggested Agenda:
   1. Distribution and discussion of:
      a. List of major Subcontractors and suppliers
      b. Construction schedules
      c. Contact information
   2. Organizational arrangement of Contractor's forces and personnel, and those of Subcontractors, material and equipment suppliers, and the County

3. Critical work sequencing
4. Major equipment deliveries
5. Project coordination
    a. Designation of responsible personnel
    b. Channels and procedures for communication
6. Procedures and processing of:
    a. Field decisions
    b. Proposal requests
    c. Submittals
    d. Change orders
    e. Applications for payment/Schedule of Values
    f. Contractor quality control
    g. Submittal of Shop Drawings, project data and samples
7. Adequacy of distribution of Contract Documents
8. Procedures for maintaining as built and record documents
9. Use of premises:
    a. Office, work and storage areas
    b. County's requirements
    c. Housekeeping
10. Temporary construction facilities
11. Temporary utilities
12. Safety and first aid procedures
13. Rules and regulations
14. Security procedures
15. Place, date and time for regular progress meetings
16. Completion time for contract and liquidated damages

1.04 PROGRESS MEETINGS

A. The County will schedule progress meetings every month and as required by progress of the Work with the first meeting one month after the pre-construction meeting. The CPH will prepare and distribute the meeting minutes within 7 calendar days.

B. Attendance:
    1. County
    2. Contractor
    3. Subcontractors as appropriate to the agenda
    4. Suppliers as appropriate to the agenda
    5. Others as appropriate

C. The Contractor's representative is to attend the project meetings and have the authority to act on behalf of the entity represented on field related matters. Contractor's representative is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics and provide specific information including but not limited to:
    1. Status of submittals and actions necessary to expedite them
    2. Status of activities behind schedule and actions necessary to regain the approved schedule
    3. Status of materials and equipment deliveries and action necessary to expedite materials and equipment and maintain the approved schedule
    4. Status of open RFI's and actions necessary to address them

D. To the maximum extent practicable, the Contractor is to assign the same personnel to represent the Contractor at Progress Meetings throughout the progress of the Work.

E. The Contractor is to provide a current shop drawing submittal log at each progress meeting.

F. The Contractor is to provide copies of the updated Progress Schedule at each project meeting in accordance with the General Conditions.

G. Suggested Agenda:
   1. Review and approve minutes from previous meeting
   2. Review questions and concerns from previous meeting and resolutions
   3. Review of Work progress since previous meeting to include current as-builts
   4. Contractor's/Subcontractor's workforce and equipment
   5. Progressive As-Built Drawings
   6. Surveyor's submittals
      a. As-Built Asset Attribute Data Table (see Table 01050-2)
      b. Pipe Deflection Table (see Table 01050-3)
      c. Gravity Main Table (see Table 01050-4)
   7. Field observations, problems and conflicts
   8. Construction progress and problems which impede construction schedule
   9. Shop Drawing submittal status
   10. Requests for Information (RFI) status
   11. Change order status
   12. Review of offsite fabrication and delivery schedules
   13. Corrective measures and procedures to regain approved schedule
   14. Revisions to construction schedule
   15. Job progress and schedule for succeeding work period
   16. Coordination of schedules
   17. Maintenance of quality standards
   18. Review submittal schedule; expedite as required
   19. Pending requests for information, changes and substitutions
   20. Review proposed changes for effect on construction schedule and completion date
   21. Pay application status
   22. Other business

Revision to Minutes:
   1. Unless minutes are challenged, in writing, prior to the next regularly scheduled Progress Meeting, they will be accepted as properly summarizing the discussions and decisions of the meeting.
   2. Persons challenging minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
   3. Challenge to minutes shall be settled as priority portion of "old business" at next regularly scheduled meeting.

PART 2- PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01300

SUBMITTALS

PART 1 –GENERAL

Work completed without approved Shop Drawings and/or samples shall be considered installed at the Contractor's risk.

1.01 SHOP DRAWINGS AND DATA

A. Shop Drawings defined in the General Conditions, shall complement design and construction Drawings, and shall contain sufficient detail to clearly define all aspects of the Construction. These Drawings shall be complete and detailed.

B. Contractor and Supplier's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked with specification title and numbers to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.

C. If Shop Drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in the letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, the Contractor shall not be relieved of the responsibility for executing the Work in accordance with the Contract, even though such drawings have been reviewed.

D. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, verification of conformance with applicable standards or codes, materials of construction and similar descriptive material. Materials and equipment list shall, for each item, give the name and location of the Supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

E. For all equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the Supplier's representative and service company so that service and/or spare parts can be readily obtained.

F. The Contractor will obtain an installation list from suppliers and equipment suppliers who propose to furnish equipment or products for submittal to County/Professional along with the required Shop Drawings. The installation list shall include at least five installations where identical equipment has been installed and has been in operation for a period of at least one year.

1.02 REVIEW OF SHOP DRAWINGS AND SAMPLES

A. The County/Professional's review of Shop Drawings, Data, and Samples as submitted by the Contractor will be to determine if the items(s) generally conforms to the information in the Contract Documents and is compatible with the design concept. The County/Professional's review and exceptions, if any, will

not constitute an approval of dimensions, connections, quantities, and details of the material, equipment, device, or item shown.

B. The review of drawings and schedules will be general, and shall not be construed:
   1. As permitting any departure from the Contract Documents.
   2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.
   3. As approving departures from details furnished by the County/Professional, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract Documents which the County/Professional finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or contract time, the County/Professional may return the reviewed drawings without noting an exception.

D. "Approved As Noted" - Contractor shall incorporate County/Professional's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the County/Professional acknowledging the comments and their incorporation into the Shop Drawing.

E. "Amend and Resubmit" - Contractor shall resubmit the Shop Drawing to the County/Professional. The resubmittal shall incorporate the County/Professional's comments highlighted on the Shop Drawing.

F. "Rejected" - Contractor shall correct, revise and resubmit Shop Drawing for review by County/Professional.

G. Resubmittals will be handled in the same manner as first submittals. For resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by County/Professional on previous submissions. The Contractor shall make any corrections required by the County/Professional.

H. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Drawings or Specifications, the Contractor shall give written notice thereof to the County/Professional.

I. When the Shop Drawings have been completed to the satisfaction of the County/Professional, the Contractor shall carry out the Construction in accordance therewith and shall make no further changes therein except upon written instructions from the County/Professional.

J. No partial submittals will be reviewed. Submittals not deemed complete will be stamped "Rejected" and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the County/Professional, make all submittals in groups containing all associated items for:
   1. Systems.
   2. Processes.
   3. As indicated in specific Specifications Sections.

K. All drawings, schematics, manufacturer's product data, certifications, and other Shop

Drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interfaces checking.

L. Only the County/Professional shall utilize the color "red" in marking Shop Drawing submittals.

M. Failure to comply with any of the above may result in the rejection of Shop Drawings.

1.03 PRODUCT DATA

A. Submit not less than six copies, unless approved by the County/Professional. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to the work.

1.04 MANUFACTURERS' INSTRUCTIONS

A. When required in an individual Specification Section, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing, in quantities specified for product data.

1.05 SAMPLES

A. Submit full range of manufacturers' standard colors, textures and patterns for the County's selection. Submit samples for selection of finishes within 30 days after Award of Contract. All color and finish selections must be submitted by the Contractor in a single submission, properly labeled and identified.

B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

C. Submit the number specified in the respective Specification section, but no less than two. After review one will be retained by the County. Reviewed samples that may be used in the work are indicated in the Specification Section.

D. Samples shall be delivered to the County as directed. The Contractor shall prepay shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved by the County/Professional.

E. Samples shall be of sufficient size to clearly illustrate:
   1. Functional characteristics of the product, with integrally related parts and attachments devices.
   2. Full range of color, texture and pattern.
   3. Each sample shall have a label indicating:
      a. Name of Project
      b. Name of Contractor and Subcontractor.
      c. Material or equipment represented.
      d. Place of origin.
      e. Name of product and brand (if any).
      f. Location in Project.
      g. Specification title and number.

h. Submittal number.
i. Note: Samples of finished materials shall have additional marking that will identify them under the finished schedules.

F. The Contractor shall prepare a transmittal letter, in triplicate for each shipment of samples containing the information required in paragraph herein. The Contractor shall enclose a copy of this letter with the shipment and send a copy of this letter to the Professional. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.

G. Approved samples not destroyed in testing shall be sent to the County or stored at the site of the Work. Approved samples of the hardware in good condition may be incorporated in the work if requested in writing by the Contractor and approved in writing by the County/Professional. Samples that failed testing or were not approved will be returned to the Contractor at the Contractor's expense, if so requested at time of submission.

1.06 FIELD SAMPLES

A. Provide field samples of finishes as required by individual Specifications sections. Install the sample completely and finished. Acceptable samples in place may be retained in completed Work

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1.07 DRAWINGS, PRODUCT DATA AND CERTIFICATES

A. Each letter of transmittal shall identify each and every item transmitted by title, drawing number, revision number and date.

B. The County generally will not check dimensions, quantities or schedules, except in cases where the information is lacking in the Specifications.

C. The following is applicable to submitted drawings, data and certificates:
1. Show relation to adjacent structures or materials.
2. Clearly identify field dimensions.
3. Show required dimensions and clearances.
4. Performance characteristic and capabilities shall accompany original Shop Drawing submittals
5. Wiring diagrams and controls shall accompany original Shop Drawing submittals.
6. Installation instructions shall accompany original Shop Drawing submittals.
7. Each submittal shall identify applicable Standards, such as ASTM number or Federal Specification number.
8. All information not pertinent shall be removed from the submittal, or shall be crossed out.

D. When resubmission is required, the County/Professional will return only 2 marked up copies. A third submission from the same manufacturer will not be accepted.

1.08 SUBSTITUTIONS

A. The substitution requirements of this Section are in addition to the requirements of the General Conditions and Supplementary Conditions.

B. When a particular product is specified or called for, it is intended and shall be understood that the proposal tendered by the Bidder includes those products in his Bid. Substitutions will only be considered in cases where original materials are unavailable or in an instance where substitute can be proven superior in its planned application

C. The intent of these specifications is to provide the County with a quality facility without discouraging competitive bidding. For products specified only by reference standards, performance and descriptive methods, without naming manufacturer's products, the Contractor may provide the products of any manufacturer complying with the Contract Documents, subject to the review of product data by the County/Professional as specified herein.

D. The County/Professional's approval is required for substitutions.

E. The Contract is based on the materials, equipment and methods described in the Contract Documents.

F. The County/Professional will consider proposals for substitution of materials equipment and methods only when such proposals are accompanied by full and complete technical data and all other information required by the County/Professional to evaluate the proposed substitution.

G. Do not substitute materials, equipment or methods unless such substitution has been specifically approved for this work by the County/Professional in writing. The Contractor must provide a submittal per this Section specifically requesting approval of the substitution. Failure to specifically identify the requested substitution may invalidate approval of a submittal.

1.09 AVAILABILITY OF SPECIFIED ITEMS

A. Verify prior to bidding that all specified items will be available in time for installation during Construction for orderly and timely progress of the Work.

B. In the event that specified items will not be available, notify the County/Professional prior to receipt of proposals.

1.10 OPERATING MANUALS

A. Submit all manuals in accordance with requirements of Divisions 2 through 17 of the Contract Specifications and Section 01700 "Project Closeout".

1.11 WARRANTIES, GUARANTEES AND BONDS

A. Provide as required by Technical Sections of the Specifications and Sections 01700 "Project Closeout" and the County's requirements for "Warranties and Bonds".

1.12 CADD FILES

A. The Professional's CADD files will be available on a limited basis to qualified firms at the County's prerogative. The procedure for requesting such files is noted elsewhere in these documents and there is a cost associated with handling and reproduction. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions.

B. The Professional's Drawings are to be used only for background information. If the Professional's Drawings are just reproduced and resubmitted (e.g. for ductwork drawings) they will be rejected.

C. Copies of data furnished by the County/Professional to Contractor or Contractor to County/Professional that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

D. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

E. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

1.13 PROGRESS PHOTOGRAPHS

A. Photographs and digital pictures shall be in color. Provide one (1) copy of each digital picture on each of three (3) CDs and provide one (1) print of each photograph in two (2) separate albums.

B. Photographs shall be from locations to illustrate the condition of Construction and state of progress adequately.

C. Provide up to twelve (12) digital photographs of views randomly selected by the County, taken prior to any construction and prior to each scheduled Application for Payment.

D. Deliver electronic images, prints, and negatives to the County.

E. Each print shall be single weight paper with glossy finish and the overall dimension shall be 7-1/2-inch x 10-inches (19.05 x 25.4 cm). The print shall be clear, sharp and free of distortion after the enlargement from the negative.

F. Provide loose-leaf albums for each set of photographs to hold prints with a maximum of 50 leaves per binder.

G. Each print shall be protected by flexible, transparent acetate or plastic sheet protector leaves with metal reinforced holes. Two extra leaves shall be provided in each binder.

H. Capture and provide digital, ortho-rectified, true color, aerial photographs of the complete project site prior to start of Construction and at final completion. A final 6-inch or less ground pixel resolution is required. If using traditional photography, the photos will need to be captured at an appropriate scale and scanned at a high enough dpi to yield a final ground pixel size of 6-inches or less. If captured digitally, a final 6-inches or less ground sample distance is required. The final ortho-rectified photos shall use a projection of NAD 27, state plane west and all vertical reference shall be NAVD 88, US feet. All orthophoto mosaics shall meet a final accuracy of plus or minus 5 feet.

I. Provide a total of four (4) true color, color balanced orthophoto mosaic prints. Three prints each of the pre and post construction (final completion) orthophoto mosaics for a total of six. Each orthophoto mosaic print shall be on double-weight paper with glossy finish and shall have overall dimensions of 36-inches x 58-inches. Two copies of each of the digital orthophoto mosaics shall be supplied in Geotiff format on disk for each time period (pre and post construction). The final color balanced, true color orthophoto mosaics will be projected in NAD 27, state plane west and all vertical reference shall be NAVD 88, US feet and shall meet a final accuracy of plus or minus 5 feet.

J. The Contractor shall provide before and after photographs of each portion of the site. The below ground facilities shall include all equipment, walls, floor, piping, supports and entrance. At major locations, photographs shall include before, during, and after prints and all prints shall be placed in binders in ascending date order to show the Work as it progresses.

K. Descriptive Information

1. Each photograph shall have a permanent title block on the back and shall contain the typed information and arrangement as follows:
    a. ORANGE COUNTY, FLORIDA
    b. (ENTER PROJECT NAME)
    c. BID No.: (Enter Bid Number)
    d. CONTRACTOR: (Name of Contractor)
    e. DATE: (When photo was taken)
    f. PHOTO NO.: (Consecutive Numbers)
    g. PHOTO BY: (Firm Name of Photographer)
    h. LOCATION: (Description of Location and View)

2. The Contractor shall provide the Professional with a written description of each photograph. This description shall be included in the binders and a copy shall be submitted with the CDs.

1.14 PROJECT RECORD DOCUMENTS

Project Record Documents shall be submitted in accordance with Section 01720 "Project Record Documents" of these specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Article 9 of the General Conditions contains additional provisions regarding submittals.

B. Preliminary Shop Drawing Data: Within 20 days after the Award of the Contract or before the Pre-Construction Meeting, the Contractor shall submit to the County/Professional a complete listing of manufacturers for all items for which Shop Drawings are to be submitted.

C. Shop Drawing Submittal Schedule: Within 30 days after the Notice to Proceed, the Contractor shall submit to the County/Professional a complete schedule of Shop Drawings submittals fixing the respective dates for submission, the beginning of manufacture, testing and installation of materials, supplies and equipment, noting those submittals critical to the progress schedule.

D. Submittal Log: An accurate updated log of submittals will be maintained by the Contractor and subject to review by the County/Professional at each scheduled progress meeting.

E. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Contract Drawings or specifications, the Contractor shall give written notice thereof to the County/Professional. This does not constitute a change order until accepted by the County.

F. Shop Drawing and submittal data shall be reviewed by the County/Professional for each original submittal and first resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor. The Contractor shall reimburse the County for services rendered by the County/Professional at the rate multiplied by the County's Professional multiplier based on the fee schedule provided to the County for this Project. If a County engineer is performing any portion of the review, this fee is based upon the hourly rate of the engineer times the County's multiplier for overhead, benefits, and expenses. The Contractor agrees that the County shall deduct such charges from the Contract Amount by a deductive Change Order.

G. Contractor Shop Drawing and Sample submittals shall include five copies in addition to any other copies that the Contractor wants returned. The County will retain five copies of approved submittals.

H. Identify Project, Project Number, date, dates of previous submittals, Contractor, Sub-

Contractors, suppliers with their addresses, pertinent Drawings by sheet and detail number, and Specification Section number, as appropriate. Identify all deviations from the Contract Documents. Provide space for Contractor and Professional review stamps.

I. Contractor's delivery of Shop Drawings for review shall follow a reasonable sequence, as is necessary to support the dates on the Progress Schedule and avoid an overload of Shop Drawings awaiting review at any one time. Coordinate submittal of related items.

J. Submit Shop Drawings per the schedule of Shop Drawing submittals, inserted in one loose leaf binder, with tabs and index to the County/Professional. All individual submittal sheets inserted in said binder must be clearly marked and referenced to proper paragraph and subparagraph of specifications. Cross out any items on sheets which constitute information not pertaining to equipment specified. Clearly mark all components that are provided as "optional" by manufacturer. Shop Drawings shall be approved by the Contractor prior to submittal to the County/Professional. Shop Drawings will be reviewed by the County/Professional. After County/Professional approval, reproduce and distribute in accordance with requirements herein.

K. All submissions of Shop Drawings, brochures and catalog cuts shall be accompanied by a transmittal letter listing the Drawings submitted by number and title.

L. When engineering calculations and/or professional certification of performance criteria of materials, systems, and/or equipment are required, the County is entitled to rely upon the accuracy and completeness of such calculations and certifications submitted by the Contractor. Calculations, when required, shall be submitted in a neat, clear and in an easy to follow format. Such calculations and/or certifications shall be signed and sealed by a Professional Engineer registered in the State of Florida.

M. Distribute copies of reviewed submittals to concerned parties. Instruct recipients to promptly report any inability to comply with provisions.

N. Prior to submission of Shop Drawings and samples, the Contractor shall stamp and sign the submittals. Any submission which, upon examination by the County, shows evidence of not having been thoroughly checked, or is not in compliance with the provisions of this Section will be returned to the Contractor for completion before it will be considered for review.

O. Notify the County of the need for making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the material or equipment Contactor proposes to supply.

P. On re-submittals, direct specific attention in writing or on the revised Drawings or sample to revisions other than the corrections required by County on previous submissions.

Q. All drawings, schematics, manufacturer's product data, certifications and other drawing submittals required for a system specification shall be submitted at one time as a package to facilitate interface checking.

R. The County will distribute Shop Drawings as follows for the indicated action taken:

SHOP DRAWING SUBMITTAL DISTRIBUTION						
Representative Party	No Exception Taken or Make Correction Noted			Rejected or Revise & Resubmit		
	Submittal Transmittal	Shop Drawing	Review Comment Sheet	Submittal Transmittal	Shop Drawing	Review Comment Sheet
Engineer	2 Copies	File Copy	1 Copy	Original	File Copy	1 Copy
Contractor (see Note 1)	2 Copies	1 Copy Each Submittal	1 Copy	1 Copy	All Copies Except Engineers	1 Copy
County	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
Inspector	2 Copies	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
Project Record Data (see Note 2)	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
NOTES: 1. Contractor shall distribute additional copies to Subcontractors as required. 2. Stored by Contractor to be furnished to County upon closeout.						

S. All Shop Drawings shall be accompanied with a transmittal letter providing the following information:
   1. Project Title and Contract Number
   2. Date
   3. Contractor's name and address
   4. The number of each Shop Drawing, project data, and sample required.
   5. Notification of Deviations from Contract Documents
   6. Submittal Log Number conforming to specification section numbers
   7. Submit each specification section separately.
   8. Identify each Shop Drawing item required under respective specification section.
   9. Identify resubmittal using specification section followed by A (first resubmittal), B (second resubmittal)…etc.

3.02 CONTRACTOR'S REVIEW

A. Contractor's Responsibility for Coordination: Where the dimension, size, shape, location, capacity or other characteristic affects another item, and where the Contractor selects, fabricates or installs related or adjacent products to be used, the Contractor shall be responsible for coordination of related items. The Contractor shall insure that a proper exchange of information takes place prior to or during preparation of each submittal and that submittals reflect such coordination. The notation "verify" or "coordinate" on the Drawings indicates the necessity for Contractor coordination in the particular instances used.

B. Contractor's Checking: When submittals of Subcontractors and suppliers, the Contractor shall mark all sets, indicating his corrections and comments in blue or

green. Copies marked in red may be returned for revision.

C. The Contractor is responsible to deliver and pick-up all submittals in a timely manner at the Architect's designated office. The Contractor is responsible for all related costs and expenses for the transmittal of such submittals

3.03 COUNTY'S/PROFESSIONAL'S REVIEW

A. Corrections or comments made on Shop Drawings during review do not relieve the Contractor from compliance with the requirements of Drawings and Specifications. This check is only for review of general conformance with the design concept of this Project and general compliance with information given in Contract Documents. Any substitutions or changes shall be properly noted.

B. No action will be taken on "rough-in" Shop Drawings for plumbing and electrical connections when the items of equipment are not included in the same submittal.

C. Review Time:

1. On a normal basis, each submittal will be returned to the Contractor within fifteen (15) working days of the date it is received. Some submittals may require additional time.

2. If, for any reason, the above schedule cannot be met, the Contractor will be so informed within a reasonable period and the Schedule of Submittals revised. If the specific submittal affects the critical path, the Contractor shall immediately notify the Professional in writing. In the event of separate submittals of individual components of a system, these submittals may be held until all components of the system are submitted, and the Contractor will be so notified.

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SECTION 01310

PROGRESS SCHEDULES

PART 1 – GENERAL

1.01 REQUIREMENT

A. The Contractor will submit precedence method cost-loaded Critical Path Method (CPM) Progress Schedules to the County depicting the approach to prosecution and completion of the Work. This requirement includes, but is not limited to the Contractor's approach to Activity cost-loading, recovering schedule and managing the effect of changes, substitutions and Delays on Work sequencing.

B. Contractor shall submit a Progress Schedule CPM (both in hand printed copy with network diagrams and electronic disc files) no later than twenty (20) days after receipt of the Notice to Proceed, and prior to commencing Work on the project.

C. The Progress Schedule CPM shall clearly identify all controlling items of Work and activities defined ast the critical path, which if delayed or prolonged, will delay the time of completion of the Contract. The critical path shall include a minimum 10% float time as part of the Contract Time for unforeseen conditions. Contractor shall provide additional float time above the required minimum 10% based on his experience, understanding of the scope,k and inspection of the site.

D. The Progress Schedule shall show how the Contractor's priorities and sequencing for the Work (or Work remaining) conform to the Contract requirements and the sequences of Work indicated in or required by the Contract Documents; reflect how the Contractor anticipates foreseeable events, site conditions and all other general, local and prevailing conditions that may affect cost, progress, schedule, furnishing and performance of the Work; and show how the Contractor's Means and Methods translate into Activities and logic.

E. The Progress Schedule will consist of the Initial Submittal, Payment Submittals and Revision Submittals. Upon acceptance by the County, the Initial submittal will become the As-Planned Schedule for the Work. Revision submittals upon acceptance will become the As-Planned Schedule for the Work remaining to be completed as of the submittal date for that Revision.

F. References to the Critical Path Method (CPM) are to CPM construction industry standards that are consistent with the requirements of this Section.

1.02 GLOSSARY OF TERMS

A. The following terms, whether or not already defined elsewhere in the Contract Documents, have the following intent and meanings within this Section:
   1. Activity Value (Value): That portion of the Contract Price representing an appropriate level of payment for the part of the Work designated by the Activity.
   2. As-Planned Schedule: The first, complete Initial Progress Schedule submitted by the Contractor with the intent to depict the entire Work as awarded and accepted by the

County or returned as no resubmittal required.

3. Contract Float: The number of days that an activity or sequence of activities does not necessarily have to start or end on the scheduled dates to maintain the schedule, or as a minimum number of days that an activity may be delayed from its early start date without delaying completion of the Wrok beyond the Contract Time for Substantial Completion or Final Acceptance.
4. CPM Schedule: The Progress Schedule based on the Critical Path Method (CPM) of scheduling. The term Critical Path means any continuous sequence of Activities in the Progress Schedule controlling, because of their sum duration, the Early Date of a pertinent, specified Contract Time.
5. Early/Late Dates: Early/late times of performance, based on CPM calculations, for an Activity in the Progress Schedule. Early Dates will be based on proceeding with all or part of the Work on the date when the corresponding Contract Time commences to run. Late Dates will be based on completing all or part of the Work on the corresponding Contract Time, even if the Contractor plans early completion.
6. Milestones: Key, pre-determined points of progress in the completion of a facility, denoting interim targets in support of the Contract Times. Milestones may pinpoint targets for key excavation and substructure events, significant deliveries, critical path transition from superstructure to piping and electrical rough-in and building enclosure. Also, hook-up of mechanical and electrical equipment, availability of power for testing, equipment shakedown, training of County personnel, start-up, Substantial Completion and other events of like import.
7. Official Schedule: The Initial or most recent Revision Submittal accepted by the County or returned as no resubmittal required and the basis for Payment Submittals until another Revision Submittal is submitted and accepted. The accepted Initial Submittal is also the As-Planned Schedule.
8. Payment Submittal: A monthly Progress Schedule update reflecting progress and minor adjustments on the Activities, sequencing and restraints for Work remaining.
9. Total Float: Days by which an activity may slip from its Early Dates without necessarily extending a pertinent Contract Time. Total Float at least equals Contract Float. Total Float may also be calculated and reported in working Days. When an activity is delayed beyond Early Dates by its Total Float it becomes a Critical Path activity and if delayed further will impact a Contract Time.

1.03 QUALITY ASSURANCE

A. The Contractor may self-perform the Work covered by this Section or employ a Subcontractor, subject to the County's consent. Employment of a scheduling Subcontractor shall not in any way alter or reduce the Contractor's obligations under the Contract Documents.

B. The Contractor will obtain a written interpretation from the County, if the Contractor believes that the selection of activities, logic ties and/or restraints requires a written interpretation of the Contract Documents. With each submission, the Contractor will point out by specific, written notation, any Progress Schedule feature that may reflect variations from any requirements of the Contract Documents.

C. It is the Contractor's responsibility to obtain information directly from each Subcontractor and Supplier when scoping their respective Activities, Values, logic ties and restraints.

D. Neither Acceptance nor Review of any Progress Schedule will relieve the Contractor from the obligation to comply with the Contract Times and any sequence of Work indicated in or required by the Contract Documents and to complete, within the Contract Times, any Work omitted from that Progress Schedule.

E. Neither Acceptance nor Review of any Progress Schedule will imply approval of any interpretation of or variation from the Contract Documents, unless expressly approved by the County through a written interpretation or by a separate, written notation on the returned Progress Schedule Submittal.

1.04 ALLOWANCES

A. Work covered by contractual allowances will be completed within the Contract Times. The Progress Schedule will incorporate the Contractor's best estimate of the activities, logic and restraints required, using the information in the Contract Documents or as indicated by the County in writing.

1.05 MILESTONES AND SCHEDULE RECOVERY

A. The County will select Milestones and Milestone Dates on the basis of the As-Planned Schedule. As the Official Schedule is revised, Milestone Dates will be revised accordingly. Milestone Dates will serve as target dates.

B. Whenever any Activity slips by fourteen (14) or more Days from the Late Date for an activity in the Official Schedule, Milestone Dates selected by the County, or a pertinent Contract Time, the Contractor will deliver a Revision Submittal documenting the Contractor’s schedule recovery plan and/or a properly supported request for an extension in the Contract Time. The narrative will identify the Delay and actions taken by the Contractor to recover schedule, whether by adding labor, Subcontractors or construction equipment, activity re-sequencing, expediting of submittals and/or deliveries, overtime or shift Work, and so forth. Activity shortening and overlapping shall be explained as to their basis (and be supported by increases in resources).

C. Upon evaluation of that Revision Submittal, if the County determines there is sufficient cause, the County may withhold liquidated damages or provide a notice of intent to do so, if schedule is indeed not recovered, and/or may give a notice of default.

1.06 PROGRESS SCHEDULE SOFTWARE

A. Contractor’s Progress Schedule shall be prepared using Primavera P-6, or other software approved by the County; the software shall be specifically intended for the preparation of construction schedules incorporating a critical path. The software used gy the Contractor must be approved in advance by the County. If the Contractor intends to use companion schedule reporting, analysis or graphics software tools, the Contractor will furnish to the County descriptive materials and samples describing such software tools.

1.07 NON-PERFORMANCE

A. The County may refuse to recommend all or any part of any payment, if the Contractor fails, refuses or neglects to provide the required Progress Schedule information on a timely basis. Partial payments without a properly updated Progress Schedule shall be returned to the

Contractor as non-conforming.

B. If justified under the circumstances, the County also may prepare alternate Progress Schedules, as appropriate, and deduct from the Contract Amount all related costs by Change Order and/or take other action commensurate with the breach.

1.08 REPORTS, SCHEDULES AND PLOTS

A. Schedule Reports will include Activity (ID) code and description, duration, calendar, Early Dates, Late Dates and Total Float. Separate Schedule Reports will tabulate, for each Activity, all preceding and succeeding logic types and lead times, whether CPM Plots displaying logic ties are appended or not.

B. CPM Schedule Plots will be plotted on a suitable time scale and identify the Contract Times, Critical Paths, phases and work areas on 24-inch x 36-inch or smaller sheets. Activities will be shown on the Early Dates with Total Contract Float noted by Late Date flags. For Payment and Revision Submittals plot a target comparison based on the current Official Schedule.

C. The Activity Value report will tabulate Activity code and description and Activity Value, percent complete and earned value as calculated by the scheduling software. Cash flow plots shall be provided showing the monthly and cumulative actual and planned earned values with curves shown for Early and Late Dates in the schedules. For Payment and Revision Schedule submittals, the cash flow curves shall also plot the most current Official Schedule planned earnings curves.

D. Each submittal shall include listings of all added and deleted activities, logic, constraints, Activity Value changes and update information vs. the previous Progress Schedule submittal. This list may be manually prepared or generated by accessory software that will generate such listings.

1.09 NARRATIVE REQUIREMENTS

A. The Initial Submittal narrative will describe the Contractor’s approach to prosecution of the Work and the basis for determination of activity durations, sequence and logic, including the Contractor's management of the site, e.g., lay down, staging, parking, etc.; Contractor’s phasing of the Work; use of crewing and construction equipment; identification of non-work County/Professional’s, shifts, weekend Work and multiple calendars applied to activities and an explanation of the basis for restraint dates.

B. Revision and Payment Submittal narratives will explain any changes to the approach or planning referred to in Paragraph A above on account of any change, delay, schedule recovery, substitution and/or Contractor-initiated revision occurring since the previous submittal.

C. Each narrative will list the Critical Path Activities and compare Early and Late Dates against Contract Times and Milestone Dates. Narratives shall also recap progress and Days gained or lost vs. the current Official Schedule, and identify delays, their extent and causes.

D. The Initial Submittal narrative will describe all delays occurring since Contract Award and all pending and anticipated "or equal" and substitution proposals. Payment and Revision

Submittals narratives will describe any new delays and shall certify that the Contractor has not been delayed, as of the cutoff date, by any acts or omissions of the County, except as otherwise specifically stated.

1.10 ACTIVITY REQUIREMENTS

A. Separate activities will identify permits, design when included in the Work, construction, Submittal preparation and review (and resubmission and re-review), deliveries (site or storage), testing, start-up, commissioning and Punch List. Separate Activities will be used for County-furnished equipment, interfaces with other work and other responsibilities of the County.

B. Activities will be detailed to the extent required to show the transition of trade Work. Activities will delineate the progression of the Work through mass excavation, substructure, superstructure, equipment installation, start of piping and conduit rough-in, building enclosure, mechanical and electrical equipment hook-up phase, building mechanical, electrical and plumbing (MEP), interior finishes, training of County personnel, equipment checkout & testing and start-up.

C. Submittal Activities will segregate long-lead items, any item requiring structural access and other procurements that, in the Contractor's judgment, may bear on the rate of progress. If the Contract Documents require MEP coordination drawings, separate MEP coordination drawing Activities will be used for each floor. Allow time for reviews per Section 01300 "Submittals" and the General Conditions, and revisions and re-submittals. Also include activities for or provide a separate tabular schedule of submittal dates for all Shop Drawings, product data, and samples including County furnished products and the dates reviewed submittals will be required from the County. Indicate decision dates for selection of finishes.

D. Activities will not combine separate or non-concurrent items of Unit Price or lump sum Work, Work in separate structures and Work in distinct areas, locations or floors within an area or structure; or rough-in and finish Work.

E. Activity durations will equal the work Days required to sufficiently complete the Work designated by the Activity, (i.e., when finish-to-start successors could start, even if the Activity is not quite 100% complete). Installation Activities will last from ten (10) to forty (40) workdays. Submittal review activity durations shall conform to specified timeframes.

F. Activities will be assigned consistent descriptions and identification codes. Sort codes will group Activities by building or structure, floor or area, Change Order and other meaningful schemes.

G. Activities will be assigned Activity Values as appropriate and needed to reasonably allocate the Contract Amount to the time periods that they will be earned and eligible for payment based on the Progress Schedule and Schedule of Values. Separate pay activities may be used to simplify cost-loading of the Progress Schedule. When used, pay activities shall be loaded with the cost of Work that is included, at no cost, in related (generally, concurrent) CPM activities. Pay activities shall not control the rate of progress; however, their start and finish dates shall be consistent with those of their related CPM activities to ensure accurate Early Date and Late Date cash-flow plots.

1.11 SUBMITTALS

A. Each Progress Schedule Submittal will consist of a narrative, five (5) copies of the required reports and plots and an optical ROM data disk with the Contractor's corresponding schedule.

B. The County will review Progress Schedule Submittals and return a review copy within 14 Days after receipt and the Contractor shall, if required, resubmit within 7 Days after return of the review copy.

C. Requirements for the Initial Submittal:
   1. Within twenty (20) Days after receipt of Notice to Proceed and prior to commencing Work on the Project, prepare and submit to the County the Initial Submittal of the Progress Schedule for the Work. The Initial Submittal will show the Work as awarded, without delays, Change Orders or substitutions.
      a. Activity Values will prorate Schedule of Values costs and/or pay items through to Activities. Provide a cross-reference listing with two parts; a part that will list each activity with the respective amounts allocated from each Schedule of Values and Unit Price Item making up the total value of each activity and a second part that will list the Schedule of Values and Unit Price Items with the respective amounts allocated from each activity that make up the total value of each item.
   2. After the As-Planned Schedule is established, the County will select Milestones and record the Milestone Early and Late Dates. As the Official Schedule evolves, Milestone Dates will be revised accordingly.
   3. If the County refuses to endorse the Initial Submittal (or a resubmission) as "Resubmittal Not Required," the As-Planned Schedule will not be established. In that event, the Contractor will continue to submit Payment and Revision Submittals reflecting progress and the Contractor's approach to remaining Work. The County will rely on the available Payment and Revision Submittals, subject to whatever adjustments it determines appropriate.

D. Requirements for Payment Submittals:
   1. Payment Submittals with progress up to the closing date and updated Early Dates and Late Dates for progress and remaining Activities will be due with each Progress Payment. As-built data will consist of actual dates, percent complete, earned payment, changes, Delays and other significant events occurring before the closing date.

   2. Activity percent complete and earned value should indicate a level of completion that corresponds to the Application for Progress Payment for the same period. The earned value should be calculated by the scheduling software as Activity Value times percent complete. Explanation should be provided whenever the cumulative earned value of activities in a Payment Submittal is not within 10% of the value of work completed as represented in the corresponding Application for Progress for Payment.
   3. At the Contractor’s option, a Payment Submittal may overlay minor adjustments on activities and sequencing for Work remaining. This excludes Activity re-scoping to reflect Delays, changes, schedule recovery or substitutions.

E. Requirements for Revision Submittals:
   1. Revision Submittals will be submitted when necessary because of major changes or delays affecting activities, sequencing or restraints for Work remaining and/or to put forth a schedule recovery plan. Revision Submittals may also be required because of

Contractor-initiated re-planning, or when Contractor plans to perform Work ahead or out-of-sequence that will require additional testing or inspection personnel, or when requested by the County when Work is performed out-of-sequence from the current Official Schedule such that the number of Days gained or lost cannot be determined or the scheduled dates of completion of the Work in a Payment Submittal are not viewed as reliable.

2. If requesting a time extension, the Revision Submittal should show the impact of the delay after incorporating reasonable mitigation to minimize the impact and illustrate how the number of Days requested time extension was determined. The delay should be determined as the change in the forecast Contract Completion Date(s) resulting solely from delays that entitle the Contractor to a time extension as provided in the General Conditions. Any and all Contractor slippage and delay occurring prior to and concurrent with the delay potentially entitling the Contractor to a time extension shall be incorporated in the Revision and explained such that the concurrent and non-concurrent periods of delay are indicated. If the Contractor does not follow the procedures contained in this Section or, if the Contractor's analysis is not verifiable by an independent, objective evaluation by the County using the electronic files and data furnished by the Contractor, any such extension in Contract Time will not be granted.

F. Retrospective Delay Analysis.

1. If the County/Professional refuses to endorse any Revision Submittal as "Resubmittal Not Required," the Contractor and County will use the latest Official Schedule when evaluating the effect of Delays on Contract Time and/or Contract Price. The procedure to be used will consist of progressively updating the latest Official Schedule at key closing dates corresponding to starting and finishing dates of the delays and/or dates the delays became critical or dates the Critical Path may have changed for other reasons. For each Progress Schedule iteration, slippage between actual Milestone Dates and Initial Milestone Dates will be correlated to Delays occurring solely in that iteration.
2. For each iteration, revisions in Activities, logic ties and restraints affecting Work after the closing date will be included in that Progress Schedule only if they meet any of the following conditions. First, they are Progress Schedule revisions that the County consented to contemporaneously (i.e., before the closing date) in writing. Second, they reflect comments or objections raised by or on behalf of the County and that were actually confirmed by the as-built progress. Lastly, they represent Contractor’s schedule recovery plans or other Progress Schedule revisions that were actually confirmed by the as-built progress.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01370
SCHEDULE OF VALUES

PART - GENERAL

1.01 DEFINITION

A. Schedule of Values: Schedule that divides the Contract Amount into pay items, such that the sum of all pay items equals the Contract Amount for the Work, or for any portion of the Work having a separate specified Contract Amount.

1.02 REQUIREMENT

A. The Schedule of Values established as provided in the General Conditions will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to the County. Progress payments on account of Unit Price Work will be based on the number of units completed and shall be prorated by the percent complete on the number of units installed not meeting all requirements of the Contract including testing

B. No payment will be made for Work performed on a lump sum contract or a lump sum item until the appropriate Schedule of Values is approved by the County.

C. The equitable value of Work deleted from a lump sum contract or lump sum item shall be determined from the approved Schedule of Values.

1.03 SUBMITTALS

A. Submit 3 copies of a Preliminary Schedule of Values within 15-days after the recommended award of the Contract.

B. Submit 3 copies of a proposed final Schedule of Values within 20-days after receipt of Notice to Proceed as per the General Conditions.

C. Submit the Schedule of Values, typed, on EJCDC 1910-8-E form or Orange County forms or spreadsheets provided by County. The Contractor's standard form or electronic media printout will be considered for acceptability by the County.

D. List installed value of each major item of Work and each subcontracted item of Work as a separate line item to serve as a basis for computing values for Progress Payments. Round off values to nearest dollar.

E. Coordinate listings with the Progress Schedule.

F. For items on which payments will be requested for stored materials or equipment, list sub-values for cost of stored products with taxes paid and provide corresponding schedule of value item number. Stored materials quantities shall not exceed installed quantities on bid tab or as required by the Contract Documents.

G. Submit a sub-schedule for each separate stage of Work specified in Section 01010 "Summary of Work."

H. The sum of values listed shall equal the total Contract Amount for the Work or the Contract Amount for a part of the Work with a separate Contract Amount provided for by the Contract Documents.

I. When the County requires substantiating information, submit data justifying line item amounts in question.

1.04 UNIT PRICE CONTRACTS – NOT APPLICABLE

1.05 LUMP SUM CONTRACTS

A. For lump sum contracts, if the Work involves separate facilities, e.g. multiple pump stations, the cost of the Work shall be separated by each facility and into schedule of value items. Break principal subcontract amounts down into these items; The lump sum cost for each facility shall be submitted individually and split into the schedule of values listed in items 1 through 14.
   1. Mobilization/Demobilization at no more than 5% of the base bid for the pump station.
   2. Project Record Documents at a minimum of 1% of the base bid for the pump station.
   3. Indemnification at $100.00.
   4. Clearing and grubbing
   5. Earthwork and grading
   6. Pump Station structure with masonry walls and appurtenances
   7. Pumps, piping, valves, and appurtenances within Pump Station structure
   8. Yard piping, fittings, valves, and appurtenances (outside of structures)
   9. Wastewater holding tank
   10. Site work and access drive
   11. Chain link fence and gate
   12. Electrical control panels, wiring, and connections
   13. Start-up and testing
   14. Restoration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01380

AUDIO – VISUAL DOCUMENTATION

PART 1 – GENERAL

1.01 PURPOSE AND DESCRIPTION OF WORK

The purpose of the audio visual documentation is to provide the County with regularly documented audio visual records of the Construction process from the existing conditions through final completion.

1.02 PRE-CONSTRUCTION VIDEO REQUIREMENTS INCLUDED

A. The Contractor shall employ a professional videographer to take a Pre-Construction video of the entire site including the entire entrance road beginning at International Drive, the areas of adjacent properties within 100 feet of the limits of Work, the entire site for the new building and the area where the new piping will be located. The video shall be made within 30 days of Work beginning. Special attention shall be made to show the existing paved roads, shoulders, signs, and other existing features.

B. The Contractor shall submit a quality audio-video recording documenting Pre-Construction field conditions for the entire project. When the Work includes construction of water, wastewater, reuse, or other line in the vicinity of any street or road, the Contractor shall take digital audio-video recordings of existing conditions along both sides of the street or road. The Pre-Construction video shall be submitted to the County and accepted prior to commencing any Work or using any Contractor laydown areas.

C. Electronic digital photography shall also be used as necessary to record and facilitate resolution of on-site issues through the transmission of electronic photographs by e-mail from the site to the Professional's and County's offices.

PART 2 – PRODUCTS

2.01 AUDIO-VIDEO RECORDING

A. Each audio-video recording shall be saved on appropriate DVD media viewable on standard DVD players or computer.

B. Each DVD shall contain the following information and arrangement at the beginning as a title screen:

Orange County, Florida
PROJECT NAME
PROJECT NUMBER

CONTRACTOR:	(Name of Contractor)
DATE:	(When photo was taken)
VIDEO BY:	(Firm Name of Videographer)
LOCATION:	(Description of Location(s) and View(s))

C. Each DVD recording section shall begin with an audio description of the County's name, Contract name and number, Contractor's name, date and location information such as street name, direction of travel, viewing side, etc.

D. Information appearing on the video recording must be continuous and run simultaneously by computer generated transparent digital information. No editing or overlaying of information at a later date will be acceptable.

E. Digital information to appear in the upper left corner shall be as follows:
1. Name of Contractor
2. Day, date and time
3. Name of Project & Specification Number

F. Time must be accurate and continuously displayed on the video record

G. Written documentation must coincide with the information on the DVD so as to make easy retrieval of locations at a later date.

H. The video system shall have the capability to transfer individual frames of video electronically into hard copy prints or photographic negatives.

I. Audio shall be recorded at the same time as the video recording and shall have the same information as on the viewing screen. Special commentary shall be given for unusual conditions of buildings, sidewalks and curbing, foundations, trees and shrubbery, structures, equipment, pavement, etc.

J. All DVDs and boxes shall bear labels with the following information:
1. DVD Number
2. County's Name
3. Date of Recording
4. Project Name and Number
5. Location and Standing Limit of Video

2.02 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall employ a competent photographer to take construction record photographs periodically during the course of the Work.

B. Prints: Date imprinted 8-inch x 10-inch high resolution glossy single weight color print paper; five (5) sets, bound in 3 ring binders to be provided to the County with each respective Application for Payment and distributed by the County as follows:

1. County (2 sets)
2. Engineer (1 set)
3. Contractor (1 set)
4. Project Record Data (1 set stored by Contractor to be furnished to County upon Closeout)

PART 3 – EXECUTION

3.01 VIDEO VIEWS REQUIRED

A. Complete coverage shall include all surface features within 100' of the Work area to be used by the Contractor and shall be supported by appropriate audio description made simultaneously with video coverage. Such coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, headwalls, and retaining walls, equipment, structures, pavements, manholes, vaults, handrails, etc. located within the work zone. Video coverage shall extend to the maximum height of all structures within this zone.

B. The video recorder shall take special efforts to point out and provide audio commentary on cracking, breakage, damage, and other defects in existing features.

C. All video recording shall be done during times of good visibility. No video recording shall be done during periods of visible precipitation, or when more than ten percent of the ground area is covered with standing water, unless otherwise authorized by County.

D. Prior to commencement of audio video recording, the Contractor shall notify the County in writing within 48 hours of the audio video recording. The County may provide a designated representative to accompany and observe all video recording operations. Audio video recording completed without a County Representative present will be unacceptable unless specifically authorized by the County.

3.02 AUDIO-VIDEO REQUIREMENTS

A. Major Locations:
   1. The Contractor shall provide color digital video of each major facility and structures and facilities adjacent to the Construction before construction starts.
   2. All videos shall be recorded with character generator operating with date, time, and location on screen. During video recording, the Contractor shall narrate video explaining what is being shown. All master videos shall be delivered to the County.

3. The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be used. In areas where the proposed construction location will not be readily apparent to the video recording viewer, highly visible yellow flags shall be placed, by the Contractor, in such a fashion as to clearly indicate the proposed center line of Construction. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed 10 feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.
4. All video recording shall be done during time of good visibility. No video recording shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.
5. The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and value of the surface features within that construction area's zone of influence. The rate of speed in the general direction of travel of the vehicle used during taping shall not exceed 44 feet per minute.

3.03 PHOTOGRAPHS

A. A minimum of three (3) views (top, upstream, and downstream) each shall generally be taken prior to backfilling pipelines or structures. Photographs shall be provided for:
   1. Utility conflicts/relocations
   2. Manholes
   3. Pump stations
   4. Boring and jacking
   5. Directional drilling pipe entrance and exit
   6. Valve installation
   7. Air release valve installation
   8. Fire hydrant assembly

B. Photo Identification
   1. Name of Project
   2. Name of Structure
   3. Orientation of View
   4. Date & Time of Exposure
   5. Film numbered identification of exposure

END OF SECTION

SECTION 01410

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Regulatory requirements, project permits

1.02 RELATED SECTIONS

A. General Conditions

B. Supplementary Conditions

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. All piping installed within the right-of-way of any city, county, state, or federal highway or railroad shall be in accordance with a permit to construct issued by the controlling agency and obtained by the County. In no case shall an open trench be constructed within a railroad right-of-way unless otherwise indicated.

B. Whenever the Drawings and Specifications conflict with the requirements of the permit, then the requirements of the permit shall govern and the cost of abiding by the provisions of the permit shall be considered incidental to the Contract.

C. All electrical apparatus and wiring pertaining to a piece of equipment or an appliance furnished and installed under this Contract shall comply with the National Electrical Code and shall be listed by Underwriters Laboratories or bear the approval of a recognized Testing Laboratory approved by the County.

1.04 PROJECT PERMITS

A. The following permits are being obtained from the permitting agencies for the construction of the project, and will be provided to the selected Contractor prior to award of the contract:

1. FDEP Water Permit
2. SFWMD Stormwater permit (see **Appendix 1**)

B. The Contractor shall review and become familiar with all permits for the Project, complete with all conditions, attachments, exhibits and permit modifications. A copy of all permits for the Project shall be maintained by the Contractor at the project site, and shall be available for review upon request.

C. Any permits not referenced here but that are required for the project will be obtained by the Contractor. The Contractor shall be fully responsible to abide by all provisions of the permits. The Contractor is responsible for the selection, implementation and operation of all measures required by the permits, including the maintenance of said measures as necessary during construction. No additional compensation will be allowed for any work associated with permit requirements.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01415

STORMWATER POLLUTION PREVENTION / NPDES REQUIREMENTS

PART 1- GENERAL

1.01 SECTION INCLUDES

Stormwater Pollution Prevention Plan requirements and recommendations under the NPDES program for construction projects located in Florida.

1.02 PURPOSE

The purpose of this section is to outline minimum requirements for stormwater pollution prevention as required under the NPDES program.

1.03 RELATED SECTIONS

A. Section 01410 – Regulatory Requirements

B. Section 02370 – Erosion and Sediment Control

1.04 ABBREVIATIONS

A. NPDES - National Pollution Discharge Elimination System

B. SWPPP - Stormwater Pollution Prevention Plan

C. NOI - Notice of Intent

D. NOT - Notice of Termination

1.05 DEFINITIONS

The term "NPDES Generic Permit" means the State of Florida Department of Environmental Protection (FDEP) Generic Permit For Stormwater Discharge from Large and Small Construction Activities.

1.06 CONSTRUCTION PROJECTS REQUIRING COMPLIANCE WITH NPDES GENERIC PERMIT

A. All projects one (1) or more acres in size that discharge to offsite areas.

B. Smaller projects that are in the same construction corridor as larger construction projects where the larger project is one (1) or more acre in size and is required to comply with the NPDES Generic Permit. In this case, even if the smaller project is less than one (1) acre in size, the smaller project must comply with the NPDES Generic Permit.

1.07 GENERAL REQUIREMENTS

A. Construction of this project is required to comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) Generic Permit for Stormwater Discharge from Small and Large Construction Activities.

B. In order to meet NPDES requirements, the Contractor is responsible for preparing a Stormwater Pollution Prevention Plan (SWPPP), implementing, inspecting, maintaining, and reporting on all elements of the SWPPP, completing and submitting the required Notice of Intent (NOI) and Notice of Termination (NOT) forms as the Operator, and paying all associated fees. Copies of the NPDES Generic Permit, NOI, and NOT forms, and permit application fee information are available for download at dep.state.fl.us/water/stormwater/npdes/

C. The Contractor must include in the SWPPP the names and addresses of all subcontractors working on this project who will be involved with the major construction activities that disturb site soil or who implement a pollutant control measure. These subcontractors, in addition to the Contractor, shall comply with the requirements of the NPDES Generic Permit and any local governing agency having jurisdiction concerning erosion and sedimentation control, and shall sign a copy of the certification statement in the SWPPP.

D. The SWPPP shall describe and ensure the implementation of best management practices which will be used to reduce the pollutants in stormwater discharge associated with construction activity and to assure compliance with the terms and conditions of the NPDES Generic Permit. The erosion and sediment control measures shown on these Drawings are the minimum required and are to be installed prior to construction. The Contractor is responsible for complying with all applicable rules, regulations and water quality standards and may need to install additional controls to meet these requirements.

1.08 SWPPP IMPLEMENTATION AND SUBMITTAL REQUIREMENTS

A. The SWPPP shall be completed prior to submittal of the NOI and shall include the elements necessary to comply with the NPDES Generic Permit for construction activities administered by the FDEP and shall also include all local governing agency and County requirements. There may be more stringent local government or County requirements for Erosion and Sediment Control, which would be located in the Specifications or on the Drawings. The more stringent requirement governs.

B. The Contractor must file the NOI with FDEP and the County at least two (2) business days prior to the start of construction. The Contractor shall also submit a copy of the NOI to the MS4 operator for all projects that discharge stormwater associated with construction activity to a municipal separate stormwater system (MS4). A copy of the NOI and a description of the project must be posted in a prominent place for public viewing at the construction site.

C. The SWPPP must be implemented at the start of construction. A complete copy of the SWPPP, including copies of all inspection reports, plan revisions, etc., must be

retained at the project site at all times during working hours and kept in the permanent project records for at least three years following submission of the NOT.

D. Final Stabilization means that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover (evenly distributed, without large bare areas) with a density of at least 70% for all unpaved areas and areas not covered by permanent structures has been established or equivalent permanent stabilization measures (such as geotextiles) have been employed. Once construction is completed and final stabilization has been achieved, the Contractor must file the NOT to FDEP, the County, and the MS4 operator within 14 days.

1.09 INSPECTIONS

A. It is the responsibility of the Contractor to assure the adequacy of site pollutant discharge controls. Between the time the SWPPP is implemented and final site stabilization is achieved, all disturbed areas and pollutant controls must be inspected at least once every seven calendar days and within 24 hours following a rainfall of 0.5 inches or greater. The inspections are to be conducted by the Contractor's qualified designated representative.

B. All inspections shall be documented in an inspection report that summarizes the scope of the inspection, the names and qualifications of personnel making the inspection; the date of the inspection; rainfall data; major observations relating to the implementation of the SWPPP, and actions taken in order to ensure compliance with NPDES requirements and the SWPPP. Such reports shall identify any incidents of non-compliance and actions taken to bring the project into compliance. Where a report does not identify any incidents of non-compliance, the report shall contain a certification that the facility is in compliance with the NPDES requirements and the SWPPP. Each inspection report shall be signed and certified by each inspector.

1.10 UPDATING AND MODIFYING THE SWPPP

A. Based on inspection results, any modifications necessary to increase effectiveness of the SWPPP to an acceptable level must be made within seven calendar days of the inspection.

B. The SWPPP must be updated each time there are significant modifications to the pollutant prevention system or a change of contractors working on the project who disturbs site soil. For construction activities where the operator changes, the new operator shall file an NOI for coverage under this permit at least two (2) days before assuming control of the project and the previous operator shall file an NOT to terminate permit coverage in accordance with the NPDES Generic Permit. Amendments to the plan shall be prepared, signed, dated, and kept as attachments to the original SWPPP.

1.11 MINIMUM SWPPP PROVISIONS

A. Each SWPPP shall provide a description of pollutant sources and other information including a description of the nature of the construction activity; the intended sequence of major activities which disturb soils for major portions of the site; estimates of the total area of the site and the total area of the site that is expected to be disturbed by excavation, grading, or other construction activities; existing data describing the soil or the quality of any discharge from the site and an estimate of the size of the drainage area for each discharge point; a site map indicating drainage patterns and approximate slopes anticipated after major grading activities, areas of soil disturbance, an outline of areas which may not be disturbed, the location of major structural and nonstructural controls identified in the plan, the location of areas where stabilization practices are expected to occur, surface waters, wetlands, and locations where stormwater is discharged to a surface water or MS4; and the latitude and longitude of each discharge point and the name of the receiving water(s) for each discharge point.

1.12 MINIMUM EROSION AND SEDIMENT CONTROL CONSTRUCTION REQUIREMENTS

A. Stabilize all construction site exits with coarse aggregate or other approved materials, in accordance with details on the Drawings. Other minimum construction requirements that need to be implemented in order to comply with the NPDES Generic permit include installation of sediment barriers down slope from construction activities that disturb site soil; constructing rock surface temporary parking areas; installation of sediment barriers down slope prior to clearing and grubbing; installation of sediment barriers on the down slope side of utility construction and soil stockpiles; and the installation of sediment barriers on the down slope side of grading activities.

B. Stabilization measures shall be initiated as soon as practicable, but in no case more than 7 days, in portions of the site where construction activities have temporarily or permanently ceased.

C. The County has the authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, trenching, borrow and embankment operations. The County also has authority to direct Contractor to provide immediate permanent or temporary erosion and sediment control measures

D. The Contractor shall respond to erosion and sediment control maintenance requirements or implement additional measures to control erosion ordered by County or governing authorities within 48 hours or sooner if required at no additional cost to the County.

E. The Contractor shall incorporate permanent erosion control features into project at earliest practical time to minimize need for temporary controls.

F. For drainage basins with 10 or more disturbed acres at one time, a temporary (or permanent) sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent control measures, shall be provided where attainable until final stabilization of the site. The 3,600 cubic feet of storage area per acre drained does not apply to flows from offsite areas and flows from onsite areas that are either undisturbed or have undergone final stabilization where such flows are diverted around both the disturbed area and the sediment basin. For drainage basins with 10 or more disturbed acres at one time and where a temporary sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent controls is not attainable, a combination of smaller sediment basins and/or sediment traps and other BMPs should be used. At a minimum, silt fences, or equivalent sediment controls are required for all sideslope and downslope boundaries of the construction area.

G. Water trucks shall be used as needed during construction to reduce dust generated on the site. Dust control must be provided by the Contractor and shall be in compliance with applicable local and state dust control regulations.

1.13 MAINTENANCE REQUIREMENTS

A. Maintain all erosion and sediment control measures throughout construction. Repair or replace all damaged sediment barriers. Remove accumulated sediment along all silt fences where the height of the sediment exceeds one-third of the height of the silt fence. Inspect all temporary and permanent grassing areas and re-grass where there are bare spots, washouts, or unhealthy growth.

B. At the completion of construction, once final stabilization has been achieved, clean all accumulated sediment from all storm structures, pipelines, and stormwater ponds. Remove all temporary sediment controls upon receipt of authorization to remove has been received from the County or Engineer. Note that this may not occur for some time after construction activities have been completed, in order to ensure their removal has not occurred until final stabilization has been achieved to the satisfaction of the County and Engineer.

1.14 STORMWATER DISCHARGE PROVISIONS

A. Non-stormwater components of site discharge must be clean water. Water used for construction, which discharges from the site, must originate from a public water supply or private well approved by the governing local agency. Water used for construction that does not originate from an approved public supply must not discharge from the site. Allowable non-stormwater discharges include discharges from firefighting activities; Fire hydrant flushing; Water used to wash vehicles or control dust; Water flowing from potable sources and water line flushing; Irrigation drainage; and runoff from pavement wash down where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents have not been used.

B. Solid materials, including building materials, are not allowed to be discharged from the site with stormwater. All solid waste, including disposable materials incidental to the major construction activities, must be collected and placed in containers. The

containers shall be emptied periodically by a contract trash disposal service and hauled away from the site.

C. Substances that have the potential for polluting surface and/or groundwater must be controlled by whatever means necessary in order to ensure that they do not discharge from the site. As an example, special care must be exercised during equipment fueling and servicing operations. If a spill occurs, it must be contained and disposed so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil in accordance with local and state regulations.

D. All personnel involved with construction activities must comply with state and local sanitary or septic system regulations. Temporary sanitary facilities shall be provided at the site throughout the construction phase. They must be utilized by all construction personnel and shall be serviced by a commercial operator.

E. Discharges resulting from groundwater dewatering activities at construction sites are permitted provided the groundwater is free of sediments, is not contaminated, and dewatering occurs in accordance with state and local governing agency regulations.

F. Chemicals, paints, solvents, fertilizers, and other toxic material must be stored in waterproof containers. Except during application, the contents must be kept in trucks or within storage facilities. Runoff containing such material must be collected, removed from the site, treated, and disposed at an approved solid waste or chemical disposal facility.

G. The discharge of hazardous substances or oil in the stormwater discharge(s) from a facility or activity shall be prevented. This does not relieve the operator of the reporting requirements of 40 CFR part 117 and 40 CFR part 302. The operator shall submit within 14 calendar days of knowledge of the release a written description of: the release (including the type and estimate of the amount of material released), the date that such release occurred, the circumstances leading to the release, and remedial steps to be taken. The SWPPP must be modified within 14 calendar days of knowledge of the release to: provide a description of the release, the circumstances leading to the release, and the date of the release. In addition, the plan must be reviewed to identify measures to prevent the reoccurrence of such releases and to respond to such releases, and the plan must be modified where appropriate.

CONTRACTOR AND SUBCONTRACTOR CERTIFICATION

The Contractor and subcontractor(s) that will implement the pollutant control measures described in the SWPPP must be identified below. Each must sign a statement certifying that they understand the NPDES Generic permit authorizing stormwater discharges during construction. These statements must be maintained in the SWPPP file on site.

Contractor implementing the SWPPP:

_____

Business Name

_____

Business Address

_____

_____

_____

Business Telephone Number

CERTIFICATION: (Note signature requirements in Part VI.G. of the NPDES Generic Permit.)

a. *"I certify under penalty of law that I understand, and shall comply with, the terms and conditions of the Generic Permit for Stormwater Discharge from Large and Small Construction Activities and this Stormwater Pollution Prevention Plan prepared thereunder."*

_____

Signature Date

_____

Printed Name

CONTRACTOR
CERTIFICATION

The SWPPP has been prepared by:

_____

Business Name

_____

Business Address

_____

_____

_____

Business Telephone Number

The Contractor who has prepared the SWPPP shall make the following certification:

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

_____

Signature Date

_____

Printed Name

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

SECTION 01450

QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

Quality control, quality assurance

1.02 QUALITY CONTROL

A. It is the Contractor's responsibility to perform all work to a degree and in a manner that satisfies and complies with the Project requirements. In order to fulfill this responsibility, the Contractor is required to have an approved Quality Control Program, including testing, as part of his Contract work in accordance with the Contract Documents and to submit details of his Program to the County for review and approval prior to commencing any construction operations. The submittal shall include detailed information on locations and number of all tests, etc., that will be necessary for the Contractor to make his own determination that the work is being performed in compliance with the Project requirements.

B. As part of the Contractor's Quality Control Program included as part of his work, the Contractor shall employ and pay for an independent, approved soils testing laboratory to perform testing services outlined in these Contract Documents.

C. The Contractor's Quality Control Program shall include, but not be limited to, the following in addition to the type and frequency of tests as required by the technical specifications:

1. Piping and structural excavation, bedding and backfill materials and density quality control testing.

2. Determination of compaction effort needed for compliance with the density requirements.

3. Portland cement concrete and asphalt paving quality control testing including design mix review, materials, field slump and air content, and field and lab cured strength samples and testing

D. In addition to Quality Control Testing, the Contractor shall be responsible for required testing or approvals for any work (or any part thereof) if laws or regulations of any public body having jurisdiction specifically require testing, inspections or approval. The Contractor shall pay all costs in connection therewith and shall furnish the County the required certificates of inspection, testing or approval. The Contractor shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with County acceptance of a supplier of materials or equipment proposed to be incorporated into the work.

E. Any design or testing laboratory utilized by the Contractor shall be an independent laboratory acceptable to the County, approved in writing and complying with the

latest edition of the "Recommended Requirements for Independent Laboratory Qualification", published by the American Council of Independent Laboratories.

F. Testing laboratories, whether provided by the County or the Contractor, shall promptly notify the County and the Contractor of irregularities or deficiencies of work which are observed during performance of services. Laboratories shall submit two (2) copies of all reports directly to the County and two (2) copies to the Contractor.

1.03 QUALITY ASSURANCE

A. The County will employ an independent soils laboratory as part of County's Quality Assurance Program to verify that the work meets the requirements of the Contract Documents. The Contractor shall cooperate with the County and make the work and samples available for County testing at no additional cost. It is the sole responsibility of the Contractor to see that his work meets all provisions of the Contract Documents. If any test fail, Contractor shall be responsible for payment of all additional tests.

B. The Contractor shall cooperate with the soils laboratory personnel and provide access to the work to be tested. The Contractor shall notify the County's testing laboratory sufficiently in advance of operations to allow scheduling of tests. The Contractor shall furnish casual labor and facilities to obtain and handle samples at the site and to store and cure test samples as required.

1.04 TESTING OF MATERIALS

A. Unless otherwise specified, all materials shall be sampled and tested in accordance with the latest published standard methods of ASTM in effect at the time bids are received. If no ASTM Standards apply, applicable standard methods of the Federal Government or of other recognized agencies shall be used.

B. Test of materials shall be made by a representative of the Contractor, unless otherwise provided. Testing of equipment shall be the responsibility of the Contractor or an authorized manufacturer's representative. All test results shall be furnished to the County in writing. The Contractor shall provide facilities required to collect and forward samples. The Contractor shall furnish the required samples without charge.

C. The Contractor shall not make use of or incorporate in the work, the materials represented by the sample until tests have been made and the material found to be in accordance with the requirements of the Specifications.

D. Materials to be tested and the applicable test procedure shall be as outlined in the individual sections of these Specifications.

1.05 SOURCE AND QUALITY OF MATERIALS AND EQUIPMENT

A. The source of materials to be used shall be in accordance with the Contract Documents and as approved by the County before delivery. The approval of the source of any material shall continue as long as the material conforms to the Specifications.

B. All material not conforming to the requirements of the Specifications shall be considered as defective and shall be removed from the work. If in place, faulty materials shall be removed by the Contractor at his expense and replaced with acceptable material unless permitted otherwise by the OWNER. No defective materials which have been subsequently corrected shall be reused until approval has been given.

C. Upon failure of the Contractor to comply immediately with any order of the County to remove and replace defective material, the County shall have authority to remove and replace defective materials, and to deduct the cost of removal and replacement from any monies due or to become due to the Contractor. Failure to reject any defective materials or work at the time of installation shall in no way prevent later rejection when such defects are discovered, nor obligate the County to final acceptance.

1.06 CONSTRUCTION PROGRESS PHOTOGRAPHS

Contractor shall be responsible for taking construction progress photographs throughout the progress of the work. This may include but not be limited to photos for water line crossings of other utilities, valve installations, service connections fittings, etc. Copies of the photos shall be in digital format and be provided to the County RPR on a weekly basis.

1.07 ADDITIONAL TESTING

In addition to soils laboratory and materials testing, the Contractor shall perform other testing called for in the Contract Documents including but not limited to piping, pressure, leakage, infiltration and exfiltration, as appropriate.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

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SECTION 01560

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary to protect the Work and prevent sedimentation from the Contractor's activities from entering water bodies or enter other parts of the County's or other property owners sites outside the Construction limits.

B. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces, and providing interceptor ditches at end of berms and at those locations which will ensure that erosion during Construction will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.

C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.

1.02 REQUIREMENTS

A. The Contractor is responsible for providing effective temporary erosion and sediment control measures during Construction or until final controls become effective.

B. The Contractor shall be responsible for filing Notice of Intent for Construction Activities with regulatory agencies (SJRWMD, SFWMD, FDEP) as required by law, if thresholds are expected to be exceeded.

C. The areas of unstabilized soil cover shall be minimized at all times to limit erosion and sedimentation.

1.03 SUBMITTALS:

A. The Contractor shall prepare and submit an Erosion and Sedimentation Control Plan (Storm Water Pollution Prevention Plan) for County review and approval. The Plan shall be in effect throughout the Construction duration.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

A. Seed: Scarified Argentine Bahia.

B. Sod: Bermuda grass, Argentine Bahia grass, Pensacola Bahia grass or St. Augustine.

C. Grassing and Sodding Materials: As specified in Section 981 FDOT Specification for Road & Bridge Construction.

D. Netting: Polypropylene mesh netting 5/8-inch x 3/4-inch (16 x 19mm) mesh with interwoven curlex fibers as manufactured by American Excelsior Company or equal. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

2.02 SEDIMENTATION CONTROL

A. Bales: Synthetic bales only (per FDOT Standards). Minimum dimensions of 14-inch by 18-inch by 36-inches at the time of placement.

B. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

C. Sediment Control Fencing (Silt Fencing): As manufactured by American Excelsior Company or equal.

D. Filter stone: Crushed stone conforming to Florida Department of Transportation Specifications.

E. Concrete block: Hollow, non-load bearing type.

F. Concrete: Exterior grade not less than 1-inch thick.

G. Turbidity Barriers: Floating or staked as required.

PART 3 - EXECUTION

3.01 TEMPORARY EROSION CONTROL

A. See Sections 2.01 and 2.02 above.

3.02 SEDIMENTATION CONTROL

A. Install and maintain silt fences and dams, traps, barriers, and appurtenances as shown on the approved descriptions and working Drawings. Replace deteriorated hay bales and dislodged filter stone. Repair portions of any devices damaged at no additional expense to the County.

B. Install all sediment control devices in a timely manner to ensure the control of sediment. At sites where exposure to sensitive areas is likely, complete installation of all sediment control devices before starting earthwork.

C. Use approved temporary erosion control features to correct conditions that develop during Construction that were not foreseen when the Erosion and Sedimentation Control Plan was first approved.

3.03 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results that comply with the requirements of the Regulatory agency having jurisdiction, the County or the Professional, the Contractor shall immediately take whatever steps necessary to correct the deficiency at its own expense to protect the Work and any adjacent property to the site, as well as to prevent contamination of any river, stream, lake, tidal waters, reservoir, canal or other water impoundments.

B. The side slope areas with unstabilized or unprotected soil cover shall be minimized at all times to limit erosion and sedimentation.

C. Incorporate permanent erosion control features into the Project at the earliest practical time.

D. Remove temporary erosion and sedimentation controls when the Work is complete and in accordance with the Erosion and Sedimentation Control Plan (Storm Water Pollution Prevention Plan) and the Notice of Intent for Construction Activities filed with regulatory agencies.

3.04 MAINTENANCE OF EROSION AND CONTROL FEATURES

A. Provide routine maintenance of permanent and temporary erosion control features, at no expense to the County, until the Project is complete and accepted.

END OF SECTION

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SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall furnish, install, and maintain all sign materials including sign posts, weighted stands, brackets, any required mounting hardware, and miscellaneous materials required for temporary signs for the purpose of:
   1. Project Identification.
   2. Informational signs to direct traffic.
   3. On-site safety signs as appropriate for the Work.

B. Remove temporary signs on completion of Construction prior to obtaining Certificate of Occupancy and Substantial Completion.

C. Allow no other signs to be displayed without written approval of the County.

1.02 SUBMITTALS

A. Submit complete Shop Drawings identifying locations, material, layout, sign content, font type and size, and sample colors. Make sign and lettering to scale, clearly indicating condensed lettering if used. The sign details will be submitted to the County for approval prior to fabrication.

B. Submit method of erection to include materials, fasteners, and other items to assure compliance with the requirements for wind pressures as required by the authorities having jurisdiction.

C. Submit signs in accordance with any details provided in the Drawings.

D. Prior to erection obtain and submit all required permits from the authorities having jurisdiction.

1.03 PROJECT IDENTIFICATION SIGN

A. Provide one painted sign at the site, or at each end of the Work if a linear project, or at each of the separate sites of Work, if applicable. The sign will be not less than 32 square feet area, with a minimum dimension of 4 feet and painted graphics with content to include:
   1. Title of Project.
   2. Orange County Government name and logo.
   3. Names and titles of the Board of County Commissioners, County Administrator,
   4. Director of Orange County Utilities Department, the Consulting Engineer, and the Contractor.

B. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the County. The sign must be located 5 feet from all rights-of-way and 20 feet from all property lines.

1.04 INFORMATIONAL SIGNS

A. All signs and other traffic control devices shall conform to the requirements for shape, color, size, and location as specified in the latest Manual on Uniform Traffic Control and Safe Streets and Highways and the Florida Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations. Information as to the above may be obtained from FDOT Division engineers.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New construction grade lumber, structurally adequate and suitable for exterior application and specified finish.

B. Sign Panels: New A-B Grade, exterior type, APA DF plywood with inset hardwood edges and mitered corners, standard large sizes to minimize joints.
1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles, minimum ¾-inch.

C. Rough Hardware: Galvanized steel, of sizes and types to enable sign assemblies to resist wind pressures as required by the authorities having jurisdiction but not less than a wind velocity of 50 mph.
1. Use minimum ½-inch diameter button head carriage bolts to fasten sign panels to supporting structures. Bolt heads to be painted to match sign face.

D. Paint: Exterior quality, as specified in Division 9 or as a minimum as specified herein.
1. Primer and finish coat - exterior, semi-gloss, alkyd enamel.
2. Colors for structure, framing, sign surfaces, and graphics: As shown on the Drawings or as selected by the County.

E. Safety Sign Number Tags.
1. Removable aluminum or galvanized steel, with 4-inch high, blue numerals and steel tag hooks.

PART 3 - EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Install project identification signs within 10 days of the Notice to Proceed date. Failure to erect the signs may be reason to delay approval of the initial Application for Payment.

B. Paint exposed surfaces of supports, framing, and surface material; one coat of primer and two coats of finish paint.

C. Set signs plumb and level and solidly brace as required to prevent displacement during the Construction period. If mounted on posts, sink posts 3 feet to 4 feet below grade, leaving a minimum of 8 feet of each post above grade for mounting the sign.

D. Install informational signs at a height for optimum visibility, on ground mounted poles or attached to temporary structural surfaces.

3.02 MAINTENANCE

A. Maintain signs and supports in a neat, clean condition; repair damages to structure, framing, or sign.

B. Relocate informational signs as required by the progress of the Work.

C. Poorly maintained, defaced, damaged, or dirty signs shall be replaced, repaired, or cleaned without delay.

D. Special care must be taken to ensure that construction materials and dust are not allowed to obscure the face of a sign.

E. Signs not in effect shall be covered or removed.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at Substantial Completion of the Work.

B. Leave areas clean and patch as required to remove any traces of temporary signs.

END OF SECTION

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SECTION 01590

CONSTRUCTION FIELD OFFICE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Contractor provision of temporary utilities to include electricity, lighting, internet connectivity, heat, ventilation, telephone service, water, and sanitary facilities.

B. Contractor provision of temporary controls to include barriers, enclosures and fencing, and water control.

C. Contractor provision of temporary facilities to include access roads, parking, and temporary buildings.

E. Restrictions on the use of existing adjacent facilities.

F. Project identification signs.

1.02 TEMPORARY ELECTRICITY

A. Provide and pay for power service required for Construction and testing from local utility source.

B. Provide temporary electric feeder from existing electrical service at location as directed by utility company. Power consumption will not disrupt the County's need for continuous service. Coordinate with the County before making taps or disturbing existing service.

C. Provide separate metering and pay for cost of energy used until substantial completion. If electric service is turned over to and paid for by the County prior to substantial completion, reimburse the County for energy used up to substantial completion.

D. Provide power outlets for Construction operations, with branch wiring, distribution boxes located as required and grounding as required by NEC and local electrical codes. Provide OSHA approved flexible power cords as required.

E. Contractor-installed permanent convenience receptacles may be used during Construction.

1.03 TEMPORARY LIGHTING

A. Provide and maintain adequate lighting for Construction operations to achieve a minimum lighting level of one (1) watt/sq ft.

B. Provide and maintain 2 foot candle lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior Work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be used during Construction.

1.04 TEMPORARY HEAT AND COOLING

A. Provide and pay for heating and cooling as required to maintain specified conditions for Construction operations or as required for proper conduct of operations included in the Work.

B. Prior to operation of permanent equipment for temporary purposes, verify that installation is approved for operation, equipment is lubricated and temporary filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

C. Maintain minimum ambient temperature of 50 degrees F and maximum relative humidity of 50 percent in areas where Construction is closed in and final finishes are to be placed, unless indicated otherwise in specifications.

1.05 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.06 TEMPORARY WATER SERVICE

A. Provide, maintain, and pay for suitable quality water service required for Construction operations. Coordinate with the County if water supply is not separately metered. Pay all costs and expenses associated with such use.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.07 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures on-site. Maintain daily in clean and sanitary condition.

1.08 BARRIERS

A. Provide barriers to prevent unauthorized entry to Construction areas and to protect existing facilities and adjacent properties from damage from Construction operations.

B. Provide barricades required by governing authorities for public rights-of-way.

C. Provide protection for plant life designated to remain. Replace damaged plant life.

D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.09 FENCING

A. Unless directed otherwise in other sections of the Contract Documents, provide a 6 foot high fence completely around Construction site; provide with hinged vehicular and pedestrian gates with locks. Fencing will be galvanized, 2-inch mesh, chain link with solid top rail. Provide line posts and end posts as needed to maintain stretched and uniform fencing with no sags.

B. Fencing plan will be approved by the County for each phase of the project. Submit fencing layout diagram prior to the Pre-Construction meeting.

C. Provide visual fabric barrier at least 6 foot high on all fencing separating parking areas from Construction activities. Submit barrier fabric for approval before starting fencing. Barrier fabric will be capable of retaining physical integrity and color during the entire Construction period.

1.10 ACCESS ROADS

A. Provide and maintain uninterrupted public access to the existing Orange County properties, OOCEA's roadways, Hunter's Creek properties, and the properties located off of the Project's site access roads. Construction activities will not interfere with access to any properties. If Contractor fails to maintain access after 2 written notices within a 24 hour period, the County reserves the right to correct such situation and back charge the Contractor.

B. Contractor shall maintain the existing access roads and any temporary access roads throughout the duration of the construction activies. Contractor shall maintain Orange County's two existing access roads throughout construction to the project site for both the Contractor's deliveries and for the Owner's use of their Westerly Effluent Disposal Site.. One access road is located west of the site, off of International Drive crossing beneath the 417 and it's off ramps; the second access road is located within the Hunter's Creek subdivision off of Town Center Drive. Refer to Drawing No. G200 for location of access roads.

C. Contractor shall regrade and restore existing Orange County Utility Department's gravel access roads to existing conditions following construction activities.

D. Extend and relocate access roads as Work progress requires. Provide detours necessary for unimpeded traffic flow.

E. Provide and maintain access to fire hydrants, free of obstructions.

F. Designated existing on-site roads may be used for Construction traffic. Repair or restore any damaged areas caused as a result of Construction activity. Such repair will be to a like-new condition.

1.11 PARKING

A. Provide temporary surface parking areas to accommodate Construction personnel.

B. Do not allow Construction vehicle parking on existing pavement unless approved by County.

1.13 SPECIFIC REQUIREMENTS FOR THE FIELD OFFICES

Provide the following for the exclusive use of the County: (Unless otherwise noted, the quantity should be sufficient for the duration of the Work.)

A. Office Furnishings: The furniture will be delivered and placed as directed by the County.

B. Desks: Flat top, double pedestal, with one box and one file drawer in each pedestal, 36-inches by 60-inches. Total quantity will be two (2).

C. Chairs: Two (2) slegged-type chairs, adjustable heights, on rollers, with armrests.

D. Conference Table and Chairs: Two (2) tables (3' x 8' minimum), scratch and stain resistant and fifteen (15) meeting-type chairs.

E. Drawing Table: Two (2) plywood or standard drawing tables, 3-feet by 6-feet, with all required appurtenances and two (2) extended height stools suitable for use at the drawing tables.

F. Printer: One (1) color laser printer with capability to copy, scan, and print pages up to and including 11-inch by 17-inch with autofeeding capability. The color printer will have a minimum color print speed of 10 pages per minute. All warranties, maintenance, servicing and sufficient appropriate ink/toner cartridges and paper for the duration of the Work.

G. One (1) each refrigerator, microwave, coffee machine, and toaster oven.

H. Computer Systems and Software:
   1. One (1) complete HP Desktop Computer with Intel Dual Core Processor, 3.0 GHz processor speed, 1.0 GB memory, 4 GB memory upgrade, 250 GB hard drive capacity, Windows XP Media Center Edition 2005 operating system, or equal, including a warranty to cover the duration of the Work.
   2. One (1) HP 17-inch LCD flat panel monitors, including a warranty to cover the duration of the Work.
   3. Provide three (1) each Microsoft wireless mouse, including a warranty to cover the duration of the Work.
   4. One (1) surge protectors, monitor wipes, and compressed gas duster in sufficient quantities for the duration of the Work.
   5. The latest version of Windows software, as required, for the operation of each computer system. The software will include the latest versions of Microsoft Office Professional (Word, Excel, Access, PowerPoint, Publisher, Outlook, etc.), Visio Professional, Adobe Acrobat latest version, Norton Virus Protection (with annual renewal of updates), Audio and DVD Player, Expedition (or appropriate software to be compatible with the Contractor's Management Plan) and an Internet Browser.
   6. Install and maintain for the duration of the Contract an office network that allows all computers to access the Internet with appropriate WiFi router and security firewalls, print to the network printers, and file documents on a common server of at least 300 GB capacity. Provide separate network hard drive backup system of sufficient size using appropriate software loaded on each computer that will backup each changed file. Provide Information Technology (IT) support to respond promptly (within two business hours) to network, connectivity or computer related problems.

I. File Cabinets, Storage, Bookcases:
   1. Three (3) Lateral Files: HON 600 Series, or equal, 42-inch wide, four-drawer.
   2. Two (2) steel vertical, hanging mobile plan stand, with approximately 12 hanging

clamps. Provide all required clamps, of sufficient length to hold the Contract Drawings.

3. Storage: two (2) industrial grade steel cabinets, locking handles, 36-inches wide by 18-inches deep by 72-inches high.
4. Bookcases: three (3) HON metal bookcases, or equal, 34-1/2-inches wide by 12-5/8-inches deep by 71-inches high, color to be selected by the Engineer.

J. Miscellaneous Field Supplies:
1. One (1) minimum/maximum digital thermometer, with batteries for the duration of the Work.
2. One (1) rain gauge.
3. One (1) paint gauge, magnetic, non-destructive type.
4. Three (3) Durabeam lanterns and three (3) rubberized, water-resistant flashlights, with batteries.

K. Digital Camera.
1. One (1) Canon Powershot, 4.0 Megapixel Digital Camera, color, built in flash, rechargeable battery.
2. Two (2) compatible Digital Memory Cards, 2 GB per each.
3. One (1) compatible Digital Camera Bag.

1.14 REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS

A. Remove all temporary utilities, equipment, facilities, and materials prior to submitting Final Application for Payment.

B. Remove temporary underground installations to minimum depth of 2 feet and Re-grade site.

C. Clean and repair damage caused by installation or use of temporary Work.

D. Restore any existing facilities used during Construction to original condition, unless otherwise directed in other sections of Contract Documents. Restore existing landscaping, drainage, paving, etc. to an "as-was" condition, unless otherwise directed in other sections of Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01610

DELIVERY, STORAGE AND HANDLING

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section specifies the general requirements for the delivery, handling, storage and protection for all items required in the construction of the Work.

B. Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means that will prevent damage, deterioration, and loss including theft and protect against damage from climatic conditions. Control delivery schedules to minimize long-term storage of products at the site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss. Damaged or defective items, in the opinion of the County, will be replaced at no cost to the County.

1.02 REQUIREMENTS

A. The Contractor is responsible for all material, equipment and supplies sold and delivered to the County under this Contract until final inspection of the Work and acceptance thereof by the County.

B. All materials and equipment to be incorporated in the Work will be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.

C. All materials and equipment, which in the opinion of the County, have become so damaged as to be unfit for the use intended or specified, will be promptly removed from the site of the Work, and the Contractor will receive no compensation for the damaged materials or equipment or for its removal.

D. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor will replace same without additional cost to the County.

1.03 DELIVERY

A. Transport and handle items in accordance with manufacturer's instructions.

B. The County and the Contractor's project superintendent must be on-site to accept all deliveries shipped directly to the job site. If the project superintendent is not present for a delivery, that delivery may be rejected by the County. If any delivery is rejected due to non-availability of the Contractor's project superintendent, delivery shall be rescheduled at no additional cost to the County.

C. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances will materials or equipment be delivered to the site more than one month prior to installation without written authorization from the County.

D. Coordinate deliveries in order to avoid delay in, or impediment of, the progress of the Work.

E. Schedule deliveries to the site not more than one month prior to scheduled installation without written authorization from the County.

F. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.

G. All items delivered to the site will be unloaded and placed in a manner that will not hamper the Contractor's normal construction operation or those of Subcontractors and other Contractors and will not interfere with the flow of necessary traffic.

H. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Maintain packaged materials with seals unbroken and labels intact until time of use.

I. Immediately on delivery, inspect shipments with the County to ensure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged. If the Contractor does not notify the County regarding the delivery and the County rejects any part of the delivery, there will be no additional cost to the County for the material to be returned. For items furnished by others (i.e. County), perform inspection in the presence of the County. Provide written notification to the County of any problems.

J. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the County.

1.04 STORAGE AND HANDLING

A. Provide equipment and personnel to handle products by methods recommended by the manufacturer to prevent soiling or damage to products or packaging, with seals and labels intact and legible.

B. The Contractor is responsible for securing a location for on-site storage of all material and equipment necessary for completion of the Work. The location and storage layout will be submitted to the County at the Pre-Construction conference.

C. Manufacturer's storage instructions will be carefully studied by the Contractor and reviewed with the County. These instructions will be carefully followed and a written record of this kept by the Contractor.

D. All material delivered to the job site will be protected from dirt, dust, dampness, water, and any other condition detrimental to the life of the material from the date of delivery to the time of installation of the material and acceptance by the County.

E. When required or recommended by the manufacturer, the Contractor will furnish a covered,

weather protected storage structure providing a clean, dry, non-corrosive environment for all mechanical equipment valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this Project.

F. 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.

G. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the County retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contract Amount. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

1.05 SPECIFIC STORAGE AND HANDLING

(Additional specific storage and handling requirements may be found in the specification sections addressing the material requirements.)

A. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) will be stored in a weather tight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the County. The building will be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.

1. All equipment will be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer. Mechanical equipment to be used in the Work, if stored for longer than ninety (90) days, will have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the County.

2. Moving parts will be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor will start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

3. Lubricants will be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants will be put into the equipment at the time of acceptance. Prior to acceptance of the equipment, the Contractor will have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer will be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment will be judged to be defective. It will be removed and replaced at the Contractor's expense.

4. Electric motors provided with heaters will be temporarily wired for continuous

heating during storage. Upon installation of the equipment, the Contractor will start the equipment, at least half load, and once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

B. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

C. Cement and lime will be stored under a roof and off the ground and will be kept completely dry at all times.

D. Brick, block and similar masonry products will be handled and stored in a manner to minimize breakage, chipping, cracking and spilling to a minimum.

E. Precast Concrete will be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking.

F. All structural and miscellaneous steel and reinforcing steel will be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams will be stored with the webs vertical.

G. Metals will be stored dry, all under cover and vented to prevent build-up of humidity, all off ground to provide air circulation.

H. Lumber will be stacked to provide air circulation. Store materials for which a maximum moisture content is specified in an area where a moisture content can be maintained.

I. Gypsum wallboard systems will be stored to protect all metal studs, furring, insulation boards, batts, accessories and gypsum board to prevent any type of damage to these materials. Rusted material components, damp or wet insulation or gypsum boards will not be accepted.

J. Acoustical materials will be delivered to the job site in unbroken containers labeled and clearly marked. Materials will not be removed from containers until ready to install, but will be stored in dry area with cartons neatly stacked. Before installation, acoustical board will be stored for not less than 24 hours in the Work area at the same temperature and relative humidity.

K. Linear items will be stored in dry area with spacers to provide ventilation. Stack linear items to prevent warping, complying with manufacturer's instructions.

L. Paints and other volatile materials will be stored within approved safety containers. No glass jugs will be permitted. Storage areas will be equipped with not less than two (2) fire extinguishers (C02 type) sufficient to discharge a distance of 25-feet when fully charged and have current tags. No other building materials will be stored in this area. Used rags will be removed daily. Clean rags will be stored in metal closed containers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01630

PRODUCT SELECTION AND SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Product selection procedures.

1.02 PRODUCT SELECTION

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

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

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

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

E. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects and are approved for use and listed in the latest edition of "Orange County Utilities Standards and Construction Specifications Manual, Appendix D – List of Approved Products," which is provided in **Appendix 3** of these technical specifications for reference.

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

G. For products specified by reference standards only, the CONTRACTOR may provide any product complying with the specified standard that is included as an approved material in the latest edition of "Orange County Utilities Standards and Construction Specifications Manual, Appendix D – List of Approved Products," which is provided in **Appendix 3** of these technical specifications for reference.

1.03 SUBSTITUTIONS

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

B. If the Contractor wishes to provide a product other than one named in the Specifications, he shall submit sufficient information to the County for evaluation and determination of acceptability of the product prior to Bid Opening.

C. The Contractor is responsible for obtaining information required by the County for the evaluation of products. The County is responsible for determination of the equality of products, and his decision shall be final, except as otherwise provided by law and funding agency regulations.

D. Substitution requests can be made after Bid Opening when:

1. A specified product is no longer available

2. The product cannot be delivered by the manufacturer in a timely manner

3. The product is found to be incompatible with other specified products

4. Proposed substitutions will yield a cost savings to the County.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01650

PUMP STATION START-UP AND TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor will conduct preliminary testing of pump station facilities, products and equipment. If the preliminary field tests disclose any items furnished under this Contract which do not comply with the requirements of the Contract Documents, the Contractor shall make all changes, adjustments and replacements required prior to Start-up Demonstration and Acceptance Testing.

B. The Contractor shall complete the "Pump Station Start-Up" Form provided in **Appendix 4** of these technical specifications.

C. The Contractor shall arrange qualified instruction by the manufacturer's representative for the County's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

D. The Contractor shall furnish all labor, fuel, energy, lubrication, water, and all other materials, equipment, tools and instruments necessary for the Start-up Demonstration and Acceptance Testing unless otherwise specified.

E. The startup and final check out shall demonstrate and ensure to the County the complete operating pump station system. The Contractor shall provide documentation certifying proper installation, testing and operation of all prescribed equipment and systems.

F. The SPCC will need to be updated to include this prior to bringing fuel on site.

G. Contractor is responsible for arranging with the County the disposal of water during test pumping.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PUMP STATION START-UP TESTING AND INSPECTION

A. The Contractor shall notify the County at least 72 hours prior to performing all testing with a County Authorized Representative.

B. The Contractor shall notify the County at least ten (10) normal working days prior to start-up.

C. The following shall have been successfully met prior to pump station start-up:
   1. A walk through letter of acceptance received;
   2. All wire checks conducted;
   3. FDEP Clearances received;
   4. FDEP placard for fuel tank if applicable;
   5. Completed "Pump Station Start-Up Report" form;
   6. Certified Boundary Survey and As-Built Survey;
   7. The Contractor shall conduct preliminary testing of equipment prior to start-up testing and make all changes, adjustments and replacements required; and

D. The intent of the start-up testing is for the Contractor to demonstrate to the County that the Work will function as a complete and operable system under normal as well as emergency operating conditions and the pump station is ready for acceptance.

E. The Contractor shall furnish all labor, fuel, energy, lubrication, water and all other materials, equipment, tools, and instruments necessary for pump station start-up testing and inspection. All material used shall be listed on the Appendix D "List of Approved Products," which is provided in **Appendix 3** of these technical specifications for reference. All required certification letters, spare parts and supplies shall be provided to the County. Listed below is a partial checklist of requirements to be met.
   1. The Contractor shall coordinate startup activities with the County, the manufacturer's representatives and Subcontractors. A factory representative knowledgeable in the mechanical and electrical equipment furnished shall inspect and supervise a start-up of their respective equipment. A minimum of one full business day shall be provided for the testing. Additional time may be necessary due to faulty or incomplete Work. Upon satisfactory completion of the equipment testing and inspection, the factory representative(s) shall issue the required manufacturer's warranty certificates.
   2. Initiate startup of each system in accordance with the operation and maintenance manual. Demonstrate that all of the components of a system are operating under their own controls as designated without overheating or overloading any parts and without objectionable vibration as determined by the County.
   3. Observe the system operation and make adjustments as necessary to optimize the system performance. Coordinate with County for any adjustments desired or operational problems requiring debugging.
   4. All functions of the pump station mechanical and electrical equipment shall be tested and inspected for operation and workmanship. All equipment shall be properly installed and meet the design performance requirements.
   5. The pumps shall be flow tested at the pump station startup to verify their performance meets the design requirements and the manufacturer's pump curve.
   6. Furnish two printed copies and three electronic copies in Acrobat "pdf" format of the Operation and Maintenance Manual for the pump station to the County.
   7. A pump station start-up report shall be completed. See "Pump Station Start-Up Report Form" in Appendix D of these specifications.
   8. The Contractor shall bear the entire expense of rectifying Work installed.
   9. The Contractor shall furnish the County with a written certification signed by

the Manufacturer's representative that the equipment has been properly installed and lubricated, is in accurate alignment, is free from undue stress imposed by piping or mounting bolts, and has been operated under full load conditions and that satisfactory operation has been obtained.

F. Re-testing: If the start-up testing does not meet the requirements, the deficiencies shall be corrected and the testing procedure will be rescheduled again.

G. All training has been completed.

H. All FDEP requirements have been satisfied.

I. Each system shall be successfully demonstrated only once, after completion of all required testing. The disciplines involved may include, but not be limited to:
   1. Mechanical
   2. Conveyance
   3. Electrical
   4. Communication
   5. Instrumentation & Controls
   6. Pneumatic
   7. Hydraulic
   8. Specialized Construction
   9. Seven (7) days required on start-up without failures prior to acceptance by County.

J. Acceptance:

   1. The pump station shall be accepted based on the pump station functioning as a complete and operable system under normal operating conditions, the approved construction documents have been met and any deficiencies that were observed and noted have been corrected.

END OF SECTION

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SECTION 01700

PROJECT CLOSEOUT

PART 1 – GENERAL

1.01 DESCRIPTION

The term "Project Closeout" is defined to include requirements near the end of the Contract Time, in preparation for Substantial Completion acceptance, occupancy by the County, release of retainage, final acceptance, final payment, and similar actions evidencing completion of the Work. Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single period for the entire Work or a series of time periods for individual elements of work that has been certified as substantially complete at different dates. This time variation, if any, will be applicable to the other provisions of this section.

1.02 SCOPE OF WORK

This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Final Cleaning
2. Substantial Completion
3. Final Acceptance

1.03 RELATED WORK

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

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

C. Section 01720 "Project Record Documents"

D. Section 01740 "Warranties and Bonds"

1.04 PREREQUISITES FOR SUBSTANTIAL COMPLETION.

When the Contractor considers the Work as substantially complete, submit to the County a written notice stating so and requesting an inspection to determine the status of completion. The Contractor will be attach to the notice a list of items known to be incomplete or yet to be corrected. Complete the following before requesting the County's inspection for certification of substantial completion.

A. In the progress payment request that coincides with or is the first request following, the date substantial completion is claimed, show 100% completion or list incomplete items, the value of incomplete work, and reasons for the Work being incomplete.

Inspection procedures include supporting documentation for completion as indicated in these Contract Documents.

B. Submit a statement showing an accounting of changes to the Contract Sum.

C. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents in accordance with the County's requirements for "Warranties and Bonds".

D. Obtain and submit lien releases enabling the County's full, unrestricted use of the Work and access to services and utilities.

E. Consult with County before submitting Record Documents in accordance with Section 01720 "Project Record Documents".

F. Submit Operation and Maintenance Manuals.

G. Make final changeover of permanent locks. Submit keys and keying schedule.

H. Deliver tools, spare parts, extra stock, and similar items, salvaged materials, borrowed materials and equipment.

I. Complete final cleaning requirements necessary for Substantial Completion.

J. Record Drawings of completed facilities, including certified copy of the Survey.

K. Copies of signed-off permits.

1.05 FINAL CLEANING

Complete the following cleaning operations prior to Substantial Completion or County occupancy.

A. Remove from job site all tools, surplus materials, construction equipment, storage sheds, debris, waste and temporary services.

B. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Structures:
   1. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
   2. Remove all traces of splashed materials from adjacent surfaces.
   3. Ensure exterior surfaces have a uniform degree of cleanliness.
   4. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
   5. Remove paint droppings, spots, stains and dirt from finished surfaces.
   6. Remove labels that are not permanent labels.
   7. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are

noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

8. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Leave concrete floors broom clean.
9. Wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
10. Clean permanent filters of ventilating systems and replace disposable filters if units were operated during construction. Clean ducts, blowers and coils if units were operated without filters during construction.

1.06 OPERATION AND MAINTENANCE MANUALS

A. The Contractor will submit the proposed format, content and tab structure for all Operating and Maintenance Manuals for the County's review and approval. The tab structure for Operating and Maintenance Manuals will follow specification division format as accepted by the Construction Specification Institute. After the County approves the proposed format, content, and tab structure for the Operating and Maintenance Manuals, the Contractor will create and deliver five (5) complete sets.

B. Operation and Maintenance documentation is required for each piece of mechanical, electrical, communications, instrumentation and controls, pneumatic, hydraulic, conveyance, and special construction. If required by the technical specifications, provide Operation and Maintenance documentation for any other product not listed in the foregoing.

C. The requirements of this Section are separate, distinct and in addition to product submittal requirements that may be established by other Sections of the Specifications. County's manuals, manufacturer's printed instructions, parts lists, test data and other submittals required by other Sections of the Specifications may be included in the Operating and Maintenance Manuals provided that they are approved and are formatted in a manner consistent with the requirements of this Section.

D. Deliver approved Operation and Maintenance Manuals directly to the County.

E. Operating and Maintenance Manual documents must include, but are not limited to, table of contents, approved submittals, manufacturer's operating and maintenance instructions, brochures, shop drawings, performance curves and data sheets annotated to indicate equipment actually furnished (e.g. identifying impeller size, model, horsepower, etc), procedures, wiring and control diagrams, records of factory and field tests and device/controller settings and calibration, program lists or data compact discs, maintenance and warranty terms and contact information, spare parts listings, inspection procedures, emergency instructions, and other Operating and Maintenance documentation that may be useful to the County. The material and equipment data required by this Section must include all data necessary for the proper installation, removal, normal operation, emergency operation, startup, shutdown, maintenance, cleaning, adjustment, calibration, lubrication, assembly, disassembly, repair, inspection, trouble-shooting, and warranty service of the equipment or materials.

F. The Contractor must bind the Operating and Maintenance Manual documents in heavy-duty, 3-ring vinyl-covered binders including pocket folders for folded sheet information. Mark binder identification on both the front and spine of each binder. Binder information must list the project title, identify separate structures or locations as applicable, identify the general subject matter covered in the manual and must include the words "OPERATING AND MAINTENANCE INSTRUCTIONS".
   1. The Contractor must submit the Operating and Maintenance documents on three-hole punch 8-1/2-inch x 11-inch sheets or on three-hole punch sheets that are foldable in multiples of 8-1/2-inch x 11-inch. The three-hole punched edge will be the left 11-inch edge.
   2. The Contractor may request waivers to the size requirement for specific instances. The Contractor's waiver request must be in writing to the County. The Contractor's waiver request must include a justification for seeking the waiver.

G. The Contractor must provide an electronic version of the complete and final Operating and Maintenance Manuals in original electronic file format on compact disc or DVD. The Contractor must also provide one electronic pdf file of each bound Operating and Maintenance Manual that represents each Manual's content. The electronic pdf file must match the Operating and Maintenance Manual content and organizational structure. The electronic version of the Operating and Maintenance Manual must also be searchable by keywords.

1.07 SUBSTANTIAL COMPLETION INSPECTION PROCEDURES

A. Upon receipt of the Contractor's request for inspection, the County will either proceed with inspection or advise the Contractor of incomplete prerequisites.

B. Following the initial inspection, the County will either prepare the certificate of Substantial Completion, or advise the Contractor of work which must be performed before the certificate will be issued. The County will repeat the inspection when requested in writing and when assured that the Work has been substantially completed.

C. Results of the completed inspection will form the initial "punch list" for final acceptance.

1.08 PREREQUISITES FOR FINAL ACCEPTANCE.

Complete the following before requesting the County's final inspection for certification of final acceptance, and final payment. List known exceptions, if any, in the request.

A. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates for insurance for products and completed operations where required.

B. Submit written certification that:
   1. The County's final punch list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
   2. The Contract Documents have been reviewed and Work has been completed in accordance with Contract Documents.
   3. Equipment and systems have been tested in the presence of the County and

are operational.

4. Work is completed and ready for final inspection.

C. Submit consent of surety.

D. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.09 FINAL ACCEPTANCE INSPECTION PROCEDURES

A. The County will re-inspect the Work upon receipt of the Contractor's written notice that the Work, including punch list items resulting from earlier inspections, has been completed, except for those items for which completion has been delayed because of circumstances that are acceptable to the County.

B. Upon completion of re-inspection, the County will either prepare a certificate of final acceptance or advise the Contractor of work that is incomplete or of obligations that have not been fulfilled, which are required for final acceptance.

C. If necessary, the re-inspection procedure will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The purpose of the Project Record Documents is to provide the County with factual information regarding all aspects of the Work, both concealed and visible, to enable future location, identification and modification of the Work without lengthy and expensive site measurement, investigation or examination.

B. These standards and procedures are for integration of digital engineering CAD drawings and attribute data into the database environments, while maintaining the integrity and positional accuracy of the data. The requirement for digital submittal of approved construction plans is to provide the County GIS with a parcel and utility base for field maintenance and operations.

C. The location of the constructed improvements as depicted in the Contract Drawings is required. To insure the Work was constructed in conformance with the Contract Drawings, the following survey documents are required to be prepared and certified by the Surveyor:

1. As-Built Asset Attribute Data Table (see Table 01050-2)
2. Pipe Deflection Table (see Table 01050-3)
3. Gravity Main Table (see Table 01050-4)
4. Boundary Survey and Survey Map Report for pump stations and easements with constructed improvements.
5. As-Built drawings shall be the same level of detail as the design plans, specifically with plan and profile information provided.

1.02 DEFINITIONS

Except where specific definitions are used within a specific section, the following terms, phrases, words and their derivation shall have the meaning given herein when consistent with the context in which they are used. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number.

A. As-Built Drawings: Drawings prepared by the Contractor's Surveyor shall depict the actual location of installed utilities for the completed Work in a full size hard copy and an electronic AutoCAD file (dwg) format.

B. Record Documents: All documents as required in subsections 1.04 and 2.02 in this specification section.

C. Boundary Survey: Boundary survey, map and report certified by a Surveyor shall be provided that meets the requirements of Chapter 5J-17 'Minimum Technical Standards', FAC.

D. Surveyor: Contractor's Surveyor that is licensed by the State of Florida as a Professional Surveyor and Mapper pursuant to Chapter 472, F.S.

E. Survey Map Report: As a minimum the Survey Map Report shall identify any corners that had to be reset, measurements and computations made, pump station and easement boundary issues, locations of constructed improvements outside boundaries, and accuracies obtained.

1.03 QUALIFICATIONS OF THE SURVEYOR

A. The Surveyor, who is proposed by the Contractor to provide services for the Project, is subject to the approval of the County. Prior to any services being performed, the Contractor shall submit the name and address of any proposed Surveyor and a written acknowledgement from the Surveyor stating that he has the hardware, software and adequate scope of services in his agreement with the Contractor to fully comply with the requirements of this specification. These submittals shall be provided to the County prior to Notice to Proceed. It is recommended that the Surveyor attend the Preconstruction meeting. Any Surveyor, who has not previously performed work for the County in the past, shall attend the Preconstruction meeting.

1.04 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of the Record Documents to one person on the Contractor's staff as approved by the County.

B. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of Drawings and other documents where such entry is required to show progress and changes properly.

C. Make entries within 24-hours after receipt of information has occurred.

1.05 RECORD DOCUMENTS AT SITE

A. Maintain at the site and always available for County’s use one (1) record copy of:
   1. Construction Contract, Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents
   2. Change Orders, Verbal Orders, and other modifications to Contract
   3. Written instructions by the County as well as correspondence related to Requests for Information (RFIs)
   4. Accepted Shop Drawings, Samples, product data, substitution and "or-equal" requests
   5. Field test records, inspection certificates, manufacturer certificates and construction photographs
   6. Progressive As-Built Drawings
   7. Current Surveyor’s tables for the As-Built Assets Attribute Data, Pipe Deflection Data, and Gravity Main Data

B. Maintain the documents in an organized, clean, dry, legible condition and completely protected from deterioration and from loss and damage until completion of the Work,

transfer of all record data to the final As-built Drawings for submittal to the County.

C. Store As-Built Documents and samples in Contractor's office apart from documents used for construction. Do not use As-Built document for construction purposes. Label each document "AS-BUILT" in neat large printed letters. File documents and samples in accordance with CSI/CSC format.

D. Record information concurrently with construction progress. Do not conceal any Work until required information is recorded.

PART 2 - PRODUCTS

2.01 AS-BUILT DRAWINGS

A. Maintain the electronic As-Built Drawings to accurately record progress of Work and change orders throughout the duration of the Contract.

B. Date all entries. Enter RFI No., Change Order No., etc. when applicable.

C. Call attention to the entry by highlighting with a "cloud" drawn around the area affected.

D. In the event of overlapping changes, use different colors for entries of the overlapping changes.

E. Design call-outs shall have a thin strike line through the design call-out and all As-Built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible.

F. Make entries in the pertinent other documents while coordinating with the County for validity.

G. Entries shall consist of graphical representations, plan view and profiles, written comments, dimensions, State Plane Coordinates, details and any other information as required to document field and other changes of the actual Work completed. As a minimum, make entries to also record:
   1. Depths of various elements of foundation in relation to finish floor datum and State Plane Coordinates and elevations.
   2. As-Built Asset Attribute Data Table shall be completed in the Drawings.
   3. When electrical boxes, or underground conduits and plumbing are involved as part of the Work, record true elevations and locations, dimensions between boxes.
   4. Actually installed pipe or other work materials, class, pressure-rating, diameter, size, specifications, etc. Similar information for other encountered underground utilities, not installed by Contractor, their owner and actual location if different than shown in the Contract Documents.
   5. Details, not on original Contract Drawings, as needed to show the actual location of the Work completed in a manner that allows the County to find it in the future.
   6. The Contractor shall mark all arrangements of conduits, circuits, piping,

ducts and similar items shown schematically on the construction documents and show on the As-Built Drawings the actual horizontal and vertical alignments and locations.

7. Major architectural and structural changes including relocation of doors, windows, etc. Architectural schedule changes according to Contractor's records and Shop Drawings.

2.02 RECORD DOCUMENTS

A. Three (3) hard copy sets and three (3) digital media sets of the final Record Documents and shall include all of the documents described below under this subsection 2.02.

B. The following documents shall be signed and sealed by the Surveyor:
1. As-Built Asset Attribute Data Table (see Specification Section 01050 "Surveying and Field Engineering," Table 01050-2 for an example)
2. Boundary Survey of pump station and Survey Map Report
3. Boundary Survey and Survey Map Report for the location of constructed pipes within any easements and right-of-way. As a minimum the Survey Map Report shall identify or describe the locations where the pipe centerline was constructed within 3- feet of the easement or right-of-way boundary, where the pipe was constructed outside the easement or right-of-way boundary, any corners that had to be reset, measurements and computations made, pump station boundary issues, and accuracies obtained. Survey map report shall be dated after the Work within the right-of-ways or easements have been completed.
4. Gravity Main Table (see Specification Section 01050 "Surveying and Field Engineering", Table 01050-4 for an example)
5. Pipe Deflection Table (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-3 for an example). An electronic blank table will be supplied by the County.

C. Digital sets of the final Record Documents including but not limited to:
1. Scanned digital copies of the final As-Built Drawings
2. Electronic Survey documents electronically sealed by the Surveyor
3. Final Record Documents information
4. Digital As-Built Drawing in the Engineer's current version of AutoCAD file (dwg) format for the Contract Drawings, updated to match the final Record Drawing information

D. Pump station site Boundary Survey and Map Report.

E. New Boundary Survey to re-establish easement corners, right-of-way monuments, or pump station site corners with monuments if destroyed by the Work.

F. Scanned Documents: Scan the Survey Documents and other Record Documents reflecting changes from the Bid Documents.

G. The scanned "As-Built" Drawing sets shall be complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the

printed set of the As-Built Drawings shall be included in the electronic drawings, with each sheet being converted into an individual tif (tagged image file). The plan sheets shall be scanned in tif format Group 4 at minimum of 400 dpi resolution to maintain legibility of each drawing. Then, the tif images shall be embedded into a single pdf (Adobe Acrobat) file representing the complete plan set. Review all Record Documents to ensure a complete record of the Project.

H. Provide an encompassing digital AutoCAD file that includes all the information of the As-Built Drawings and any other graphical information in the As-Built Drawings. It shall include the overall Work, utility system layout and associated parcel boundaries and easements. Feature point, line and polygon information for new or altered Work and all accompanying geodetic control and survey data shall be included. The surveyor's certified As-Built Asset Attribute Data shall be added to the As-Built Drawings and Surveyor shall electronically seal the data in a comma-delineated ASCII format (txt).

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION MEETING

A. Pre-construction Meeting: It is recommended that the Surveyor attend the Pre-construction meeting. At the pre-construction meeting the Contractor shall be provided with a blank electronic version of the spreadsheet for the tables: Asset Attribute Data and Pipe Deflection. The Contractor's surveyor shall use these tables to input the data and shall not alter the table format or formulas.

3.02 CONSTRUCTION PROGRESS MEETINGS

A. Contractor shall provide progressive Record Documents described below:
   1. Construction Contract, As-Built Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents.
   2. Specifications and Addenda: Record manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed as well as any changes made by Field Order, Change Order or other.
   3. Change orders, verbal orders, and other modifications to Contract.
   4. Written instructions by the County as well as correspondence related to Requests for Information (RFIs).
   5. Accepted Shop Drawings, samples, product data, substitution and "or-equal" requests.
   6. Field test records, inspection certificates, manufacturer certificates and construction photographs.

7. As-Built Asset Attribute Data Table: Surveyor shall obtain field measurements of vertical and horizontal dimensions of constructed improvements. The monthly submittal shall include the Surveyor's certified statement regarding the constructed improvements being within the specified accuracies as described in Specification Section 01050 "Surveying and Field Engineering", Table 01050-1 Minimum Survey Accuracies or if not, indicating the variances.
8. Gravity Main Table: Surveyor shall prepare and update a Gravity Main Table to include as a minimum the pipe segment identification, pipe lengths, manhole inverts and tops, and slopes for gravity mains. Surveyor shall certify the data entered are correct and indicate if the minimum slopes have not been met.
9. Pipe Deflection Table: Surveyor shall input the type of pipe, pipe manufacturer, PVC manufacturer deflection allowance, allowable angle of offset and radius of curvature, laying length of pipe, and coordinates. Surveyor shall certify the data entered are correct and indicate if the deflection allowance, offset or radius of curvature exceeds the manufacturer's recommendations.

3.03 FINAL RECORD DOCUMENTS SUBMITTAL

A. Submit the Final Record Documents within 20-days after Substantial Completion.
   1. Participate in review meetings as required and make required changes and promptly deliver the Final Record Documents to the County.

3.04 STORAGE AND PRESERVATION

A. Store Record Documents and samples at a protected location in the project field office apart from documents used for construction.
   1. Provide files and racks for storage of documents
   2. Provide locked cabinet or secure space for storage of samples

B. File documents and samples in accordance with CSI format with section numbers matching those in the Contract Documents.

C. In the event of loss of recorded data, use means necessary to again secure the data to the County's approval.
   1. Such means shall include, if necessary in the opinion of the County, removal and replacement of concealing materials.
   2. In such cases, provide replacements of the concealing materials to the standards originally required by the Contract Documents.

END OF SECTION

SECTION 01730

PUMP STATION OPERATION AND MAINTENANCE MANUAL

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section includes the submittal process for the operation and maintenance manual and the manual shall contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

1.02 SUBMITTAL SCHEDULE

A. Operation and Maintenance Manual Schedule
   1. Initial submittal within 60-days after date Shop Drawings are approved.

1.03 PREPARATION OF SUBMITTALS

A. General
   1. Materials are provided for County's use, reproduction and distribution as training and reference materials within County's organization.
   2. Applicable to hard copy or electronic media.
   3. Applicable to materials containing copyright notice as well as those with no copyright notice.
   4. Notify manufacturer of this intended use of materials provided under the Contract.
   5. Number each Operation and Maintenance Manual transmittal with the original root number of the associated Shop Drawing.
   6. Identify resubmittals with the original number plus a suffix letter starting with "A."
   7. Submittal format:
      a. Interim submittals: Submit two (2) paper copies until manual is approved.
      b. Final submittals:
         (1) Within 30-days of receipt of approval, submit one (1) additional paper copy and two (2) electronic copies on Compact Disc (CD-ROM) in Portable Document Format (PDF).
   8. Compact discs to be secured in jewel cases.
   9. Electronic copies will be reviewed for conformance with the approved paper copy and the electronic copy (PDF) requirements of this Specification.
   10. Non-conforming CDs will be returned with comments.
   11. Provide final CDs within 30-days of receipt of comments.
   12. Paper copy submittals:
      a. Submit Operation and Maintenance Manuals printed on 8-1/2 inch x 11 inch size heavy first quality paper with standard three-hole punching and bound in appropriately sized three-ring (or post) vinyl view binders with clear overlays front, spine and back.
      b. Provide binders with titles inserted under clear overlay on front and on spine of each binder.

c. As space allows, binder titles shall include, but not necessarily be limited to:
   (1) Project Name
   (2) Related Specification Number
   (3) Equipment Name(s) and
   (4) Project Equipment Tag Numbers
d. Provide a Cover Page for each manual with the following information:
   (1) Manufacturer(s)
   (2) Date
   (3) Project Owner and Project Name
   (4) Specification Section
   (5) Project Equipment Tag Numbers
   (6) Model Numbers
   (7) Engineer
   (8) Contractor
e. Provide a Table of Contents or Index for each manual.
f. Use plastic-coated dividers to tab each section of each manual per the manual's Table of Contents/Index for easy reference.
g. Provide plastic sheet lifters prior to first page and following last page.
h. Reduce Drawings or diagrams bound in manuals to an 8-1/2 inch x 11 inch or 11 inch x 17 inch size.
i. Where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.
j. Identify vinyl envelopes with Drawing numbers.
k. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project.
l. Delete or cross out information that does not specifically apply to the Project.

B. Electronic copy submittals:
1. Electronic copies of the approved paper copy Operation and Maintenance Manuals are to be produced in Adobe Acrobat's Portable Document Format (PDF) Version {5.0} or higher.
2. Do *not* password protect and/or lock the PDF document.
3. Drawings or other graphics must be converted to PDF format and made part of the PDF document.
4. Scanning to be used only where actual file conversion is not possible.
5. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.
6. Images only shall be scanned at a resolution of 300 dpi or greater.
7. Perform Optical Character Recognition (OCR) capture on all images.
8. Achieve OCR with the "original image with hidden text" option.
9. Word searches of the PDF document must operate successfully to demonstrate OCR compliance.
10. Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.
11. Normally three levels deep (i.e., "Chapter," "Section," "Sub-section").
12. Thumbnails must be generated for each PDF file.
13. Set the opening view for PDF files as follows:
    a. Initial view: Bookmarks and Page.
    b. Magnification: Fit in Window.
    c. Page layout: Single page.

d. Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.
e. All PDF documents shall be set with the option "Fast Web View" to open the first pages of the document for the viewer while the rest of the document continues to load.

14. File naming conventions
a. File names shall use a "ten dot three" convention (XXXXX-YY-Z.PDF) where XXXXX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.

Example 1:
Two (2) pumps submitted as separate Shop Drawings under the same Specification Section:
Pump 1 = 11061-01-1.pdf.
Pump 2 = 11061-02-1.pdf.

Example 2:
Control system submitted as one (1) Shop Drawing but separated into two (2) O&M volumes:
Volume 1 = 13440-01-1.pdf.
Volume 2 = 13440-01-2.pdf.

15. As a minimum, include the following labeling on all CD-ROM discs and jewel cases:
a. Project Name
b. Equipment Name and Project Tag Number
c. Project Specification Section
d. Manufacturer Name
e. Vendor Name
f. Binding
(1) Include labeled CD(s) in labeled jewel case(s).
(2) Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.
(3) Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

1.04 EQUIPMENT AND SYSTEMS

A. Submission of Operation and Maintenance Manuals for equipment and systems is applicable but not necessarily limited to:
1. Major equipment
2. Equipment powered by electrical, pneumatic or hydraulic systems
3. Specialized equipment and systems including instrumentation and control systems and system components for HVAC process system control
4. Valves and water control gates
5. Equipment function, normal operating characteristics, limiting operations
6. Assembly, disassembly, installation, alignment, adjustment, and checking instructions
7. Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions
8. Lubrication and maintenance instructions

9. Troubleshooting guide
10. Parts lists
    a. Comprehensive parts and parts price lists.
    b. List of spare parts provided as specified in the associated Specification Section.
11. Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
12. Test data and performance curves.
13. As-constructed fabrication or layout Drawings and wiring diagrams.
14. Instrumentation or tag numbers assigned to the equipment by the Contract Documents are to be used to identify equipment and system components.
15. Additional information as specified in the associated equipment or system Specification Section.

1.04 COUNTY/PROFESSIONAL'S REVIEW ACTION

A. County/Professional will review and indicate one of the following review actions:
    1. ACCEPTABLE
    2. REVISE AND RESUBMIT

B. Acceptable paper copy submittals will be retained with the transmittal form returned with a request for one (1) additional paper copy and two (2) electronic copies on CD-ROM.

C. Deficient submittals (paper copy and/or electronic copy) will be returned along with the transmittal form which will be marked to indicate deficient areas.

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1.02 RELATED WORK

A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.

B. General closeout requirements are included in Section 01700 "Project Closeout."

C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16.

1.03 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the County.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the County.

1.04 SUBMITTALS

A. Submit written warranties to the County prior to requesting a Substantial Completion Inspection as outlined in Section 01700 "Project Closeout." If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the County.

B. When a designated portion of the Work is completed and occupied or used by the County, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the County within 15-days of completion of that designated portion of the Work.

C. When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the County for approval prior to final execution.

D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

E. Prior to Substantial Completion Inspection, submit to the County two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, Subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-inch by 11-inch three-hole punched paper.
   2. Table of Contents will be neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified and the name of the product or work item.
   3. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address and telephone number of the installer, supplier and manufacturer.
   4. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name and the name, address and telephone number of the Contractor.
   5. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.05 WARRANTY REQUIREMENT

A. The Contractor will warrant all equipment in the Contractor's one-year warranty period even though certificates of warranty may not be required. For all major pieces of equipment, the Contractor shall submit a warranty from the equipment manufacturer. "Major" equipment is defined as a device having a 5 HP or larger motor or which lists for more than $1,000.00.

B. In the event that an equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at Substantial Completion, the Contractor will obtain from the manufacturer a warranty of sufficient length commencing at the time of equipment delivery to the job site, such that the warranty will extend to at least 1-year past substantial completion.

C. If an individual specification section requires a particular warranty more stringent than that required by this Section or the General Conditions, the more stringent requirements will govern for the applicable portion of the Work.

D. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty will be equal to the original warranty with an equitable adjustment for depreciation.

F. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the County has benefited from use of the Work through a portion of its anticipated useful service life.

G. County's Recourse: Written warranties made to the County are in addition to implied warranties, and will not limit the duties, obligations, rights and remedies otherwise available under the law, nor will warranty periods be interpreted as limitations on time in which the County can enforce such other duties, obligations, rights, or remedies.

H. Rejection of Warranties: The County reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

I. The County reserves the right to refuse to accept Work for the project where a special warranty, certification, or similar commitment is required on such work or part of the Work, until evidence is presented that entities required to counter-sign such commitments are willing to do so.

J. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors required to countersign special warranties with the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DELIVERABLES

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and Subcontractors, and bind into a commercial quality standard 3-ring binder; submit 5 copies of the warranties and bonds to the County for review.
   1. The warranties and bonds shall include:
      a. Equipment or product description
      b. Manufacturer's name, principal, address and telephone number
      c. Contractor, name of responsible principal, address and telephone number
      d. Local supplier's or representatives name and address
      e. Scope of warranty or bond
      f. Proper procedure in case of failure
      g. Instances which might affect the validity of warranty or bond
      h. Date of beginning of warranty, bond or service and maintenance contract
      i. Duration of warranty, bond or service maintenance contract

B. Warranties

1. Furnish an extended warranty for sanitary sewer main liner certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for 1-year from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner acceptable to the County.
2. Furnish an extended warranty for sanitary lateral liner certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for 1-year from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner acceptable to the County.

END OF SECTION

SECTION 02210

SITE ROUGH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere

A. Work under this Section includes:

Rough grading for berms, site drainage, and the site.

1.02 RELATED SECTIONS

A. Section 02230 - Site Preparation

B. Section 02250 - Compaction Control and Testing

C. Section 02310 - Finish Grading

PART 2 - PRODUCTS

2.01 GENERAL

Unless otherwise indicated, material for fills shall be surplus excavated soil and borrow material meeting the appropriate, requirements for backfill as specified in other sections and shall be subject to approval by the Engineer.

PART 3 - EXECUTION

3.01 GENERAL

Provide all rough grading and filling to achieve the lines and grades indicated on the Drawings, with an allowance for the thickness of paving, surfacing, or top soil. Material not suitable for the required fills shall be spread uniformly in designated spoil areas and compacted as specified in Section 02250 to achieve a smooth and firm surface. All earthwork shall be done in a manner that provides drainage and prevents surface drainage from entering excavations.

3.02 PREPARATION FOR FILLS, BERMS, AND EMBANKMENTS

A. Upon completion of site preparation work, remove any additional organic material or debris where fill is to be placed. Ground surfaces sloped steeper than one vertical to four horizontal shall be plowed, stepped or benched, or broken up as directed by the Engineer so the fill material will bond with the existing surface. Level surfaces shall

be disked, wetted or dried as required, and recompacted. Backfill all holes made by demolition, clearing, grubbing, and other site preparation work.

B. Lift thicknesses and compaction requirements are specified in Section 02250.

C. Compacted material that has been flooded and no longer meets the density specified shall be removed and replaced.

END OF SECTION

SECTION 02230

SITE PREPARATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Layout of work and protection of bench marks.

B. Protection of structures, trees, or vegetation to remain.

C. Clearing and grubbing.

D. Stripping and storing topsoil.

1.02 RELATED SECTIONS

A. Section 02320 - Trenching, Bedding and Backfilling

B. Section 02370 - Erosion and Sedimentation Control

1.03 COORDINATION

A. Contact Orange County Utilities to determine if there are other utilities in the area, and their location prior to any work on site.

B. Contractor is responsible for locating all utilities. Assistance will be provided by Orange County Utilities personnel.

C. Contact Sunshine State One-Call 811, to determine if there are other utilities in the area, and their location.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 BENCH MARKS AND MONUMENTS

Maintain all existing benchmarks, monuments and other reference points; if destroyed, replacement costs will be deducted from payments due the Contractor.

3.02 LAYING OUT WORK

A. Base lines, property lines, and easement lines, are shown on the Drawings. Benchmarks utilized are also shown on the drawings. If the bench marks are disturbed as a result of construction activities, reestablish such items by utilizing a Florida licensed surveyor.

B. Stake out the construction, establish lines and levels, temporary bench marks, batter boards, centerlines and reference points for the work, and verify all dimensions relating to interconnection with existing features.

C. Report any inconsistencies in the proposed grades, lines and levels, dimensions and locations to the Engineer before commencing work.

D. Unless otherwise directed by the County or Engineer, the Contractor is expected to contain all construction activities within the area as shown on the drawings. At no time shall the Contractor disturb surrounding properties or travel on surrounding properties without written consent from the property owner. Any repair or reconstruction of damaged areas in surrounding properties shall be repaired by the Contractor on an immediate basis. All costs for repairs shall be the responsibility of the Contractor and no extra compensation shall be provided.

E. The Contractor shall be responsible for locating and protecting and/or relocating all utilities lines, including irrigation lines, in the areas of the construction activities. If any existing lines are broken or damaged as a result of construction activities, the Contractor shall be responsible for repairing the lines at no additional cost to the County.

3.03 BURNING

A. Burning is not allowed.

3.04 PROTECTION OF TREES AND SHRUBS

A. Existing trees and shrubs within the booster pump station site shall remain unless specifically required to be removed as indicated on the Drawings.

B. Protect branches, trunks, and roots of trees and shrubs that are to remain. Trees to remain in the construction area shall be boxed, fenced or otherwise protected before any work is started; remove boxing when directed by the Engineer. Do not permit heavy equipment or stockpiles within branch spread. Remove interfering branches without injury to trunks and cover scars with tree paint.

C. The Contractor shall assume full responsibility for the protection of all trees and shrubs. It will be the Contractor’s responsibility to follow any ordinance pertaining to Orange County’s regulations.

3.05 RELOCATION OF UTILITIES

A. Active utilities which do not interfere with the work shall be supported and protected from damage. After obtaining the Engineer's approval, relocate or remove active utilities which will interfere with work as indicated. Pay for all damage to active utilities and for relocation or removal of all interfering utilities which are ascertainable from Drawings, surveys, site inspection or encountered during construction.

B. Inactive or abandoned utilities and appurtenant structures encountered shall be removed to avoid interference as directed by the County. Exposed ends of abandoned lines shall be plugged or capped in a water-tight manner. Any inactive or abandoned utilities shall be shown on the project record drawings.

3.06 CLEARING AND GRUBBING

A. Areas to receive clearing and grubbing shall include all areas to be occupied by the proposed improvements, areas for fill and site grading, and borrow sites. Remove trees outside of these areas only as indicated on the Drawings or as approved in writing by the Engineer or County.

B. Clearing shall consist of removing trees and brush and disposal of other materials that encroach upon or otherwise obstruct the work.

C. Exercise extreme care during the clearing and grubbing operations to not damage existing structures, pipes or utilities. Protect the existing monitoring well on-site.

D. Grubbing shall consist of removing and disposing of stumps, roots larger than 2" in diameter, and matted roots. Remove to a depth of not less than 18" below the original surface level of the ground.

E. All combustible debris and refuse from site preparation operations shall be removed to legal off-site disposal areas.

3.07 TOPSOIL REMOVAL

A. All areas to be occupied by proposed improvements, and borrow sites shall be stripped of all brush, weeds, grass, roots and other material.

B. Remove all loamy, organic topsoil suitable for seeding and planting to whatever depth encountered and store separately from other excavated material. Stockpile in designated areas and provide for proper drainage. Cover storage piles as required to prevent windblown dust.

C. In the event that inadequate space within the site or work area is available for stock-piling topsoil without interfering with other construction operations, contact County for determination of another storage location.

D. Dispose of unsuitable topsoil as specified under disposal of debris. Excess topsoil shall be removed from site unless specifically noted on Contract Drawings.

3.08 DISPOSAL OF DEBRIS

All debris (not including acceptable fill material) resulting from site preparation operations shall become the property of the Contractor and shall be removed to legal off-site disposal areas.

END OF SECTION

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SECTION 02240

DEWATERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Dewatering design and operation requirements.

1.02 RELATED SECTIONS

A. Section 02370 - Erosion and Sedimentation Control

B. Section 01415 – Stormwater Pollution Prevention/NPDES Requirements

1.03 GENERAL REQUIREMENTS

A. Refer to **Appendix 2** for observed groundwater condition and groundwater sampling results.

B. Obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work. Contractor shall be solely responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom and/or sides. Design system to prevent differential hydrostatic head which would result in floating out soil particles in a manner termed as a "quick" or "boiling" condition. System shall not be dependent solely upon sumps and/or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability.

D. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow all Work to be installed in a dry condition.

E. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

F. If dewatering is required, the Contractor shall be responsible for meeting dewatering requirements and compliance with the St. John's River Water Management District.

G. Contractor shall be responsible for and shall repair without cost to the County any damage to work in place, or other Contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation, including, damage to the bottom due to heave and including but not limited to, removal and pumping out

of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Control, by acceptable means, all water regardless of source and be fully responsible for disposal of the water.

B. Confine discharge piping and/or ditches to available easement or to additional easement obtained by Contractor.

C. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary to these purposes, lower water level in advance of excavation, utilizing wells, wellpoints, jet educators, or similar positive methods. Maintain the groundwater level to a minimum of 2 feet below excavations. Provide piezometers, if directed by the County, to document the groundwater level is being maintained.

D. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.

E. Open pumping with sumps and ditches shall be allowed, provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.

F. Install wells and/or wellpoints, if required, with suitable screens and filters, so that continuous pumping of fines does not occur. During normal pumping, and upon development of well(s), levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.

G. Control grading around excavations to prevent surface water from flowing into excavation areas.

H. Remove subgrade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the County.

I. Walls shall not be exposed to water pressure before structural work at the next higher level has properly cured and the cantilever action of walls is eliminated.

J. Any dewatering pumps within 1500 feet of private residences shall be quipped with satisfactory sound suppression.

K. Water from dewatering activities shall be disposed in a manner that does not cause flooding, erosion, or the transfer of sediments.

3.02 MAINTAINING EXCAVATION IN DEWATERING CONDITION

A. Dewatering shall be a continuous operation. Interruptions due to power outages or any other reason will not be permitted.

B. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.

C. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to County.

D. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components and any other work required to maintain excavation in dewatered condition.

3.03 SYSTEM REMOVAL

A. Remove all dewatering equipment from the site, including wells and related temporary electrical service. Restore any impacted areas to like new condition.

END OF SECTION

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SECTION 02250

COMPACTION CONTROL AND TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere

A. Work under this Section includes:

Placement, compaction control, and field density testing requirements for all earthwork, including pavement subgrade.

B. Related work specified elsewhere includes:
1. Section 02230 - Site Preparation
2. Section 02320 - Trenching, Bedding and Backfilling

1.02 TESTING

A Testing Laboratory employed by the County shall make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for all testing shall be paid by the County. However, any and all tests which have to be repeated because of the failure of the tested material shall be paid for by the Contractor and the cost of any tests shall be deducted from payments due the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials and products shall be subject to the approval of the County. All fill material shall be free of organic material, trash, or other objectionable material. Excess or unsuitable material shall be removed from the job site by the Contractor.

PART 3 - EXECUTION

3.01 FILL PLACEMENT

A. Compacted material that has been flooded and no longer meets the density specified shall be removed, replaced and recompacted.

B. If the in-place surface has dried, sprinkle with water before placing the next lift. The surface of smooth lifts shall be scarified before the next lift is placed.

C. Where fill is required on both sides of structures, fill and compact simultaneously on opposite sides in even layers. Other filling sequences shall be as specifically indicated on the Drawings.

D. Fill shall be spread in uniform horizontal lifts. The material shall be thoroughly mixed to insure a uniform moisture content slightly wetter than optimum but not greater than 5 percent above optimum water content as determined by the Modified Proctor Test, ASTM D1557.

E. Where cohesive structural fill is used, the moisture content when compacted shall be within 3 percent of the optimum moisture content. If the fill does not have a natural water content which falls within the acceptable range, the Contractor shall mix, dry, or moisten as necessary.

F. Place and compact each lift over an entire area prior to placing successive lifts, unless otherwise approved by the County.

G. All materials shall be placed in loose lift thicknesses indicated hereafter.

3.02 COMPACTION

A. General
   1. Unless otherwise indicated, the type of equipment and number of passes required to obtain the specified degree of compaction shall be as outlined in the soils report prepared for this project or as determined at the site, subject to the approval of the County.
   2. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the Engineer.

B. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated.

3.03 FILL LIFT THICKNESSES AND COMPACTION DENSITIES

Unless otherwise indicated or approved by the Engineer, place fills in the loose lift thicknesses indicated hereafter, except when water jetting, and compact to a dry density not less than the following percentage of maximum dry density, determined by the Modified Proctor Test, ASTM D1557, unless otherwise noted. All structural fill areas are to extend a minimum of five feet beyond the structure lines as outlined in the soils report

3.04 TESTING

A. The Contractor shall assist in providing samples for the following field density tests to insure required densities are being obtained for soil compaction:
   1. One test for each 300 lineal feet or fraction thereof per lift of general backfilling for pipe work.
   2. For Structures, as a minimum, one test per 100 square feet of fill area per lift, or at least two (2) per structure, per lift.

3. Two tests for each 2,500 square feet or fraction thereof per lift of structural fill under slabs, foundations, and pavements.
4. Testing for each 600 square yards of pavement, for limerock base layer.
5. One test per lift for each other type of fill, if so directed by the soils report or Engineer.

B. Tests shall be in accordance with ASTM D1557 or other tests suitable for the materials being tested.

C. The County will pay for initial field density tests. Subsequent tests and associated costs necessitated as a result of the initial tests failing to meet specified requirements will be at the expense of the Contractor.

D. For bedding and trenching details, see detail sheets of Construction Drawings.

E. Compact and Backfill excavations and construct embankment according to the following schedule.

TYPE OF FILL	USAGE	LIFT THICKNESS	REQUIRED % OF MODIFIED PROCTOR TEST
Trenched Pipe Bedding	Beneath piping 6"	6”	98% D1557
Trenched Pipe Cover	Over and/or around piping	6"	98% D1557
Utilities Trench Backfill	"Influence area" beneath other piping or utility lines	8”	98% D1557
Structural Fill	All locations	6”	98% D1557
Impermeable Fill	All locations	6"	98% D1557
Granular Fill	Below concrete slab bedding, foundations, rigid paving, and excavated areas adjacent to structures	8”	98% D1557
	All other uses	12"	95% D1557
Granular Bedding	Beneath concrete slabs	6”	95% D1557
Granular Drainage Blanket	Below concrete slabs, paving, or piping	9”	98% D2049
	All other uses	12"	95% D2049
Granular Filter	Around open joint or perforated drain pipes and at pressure relief valves	9"	95% D1557
Structural Backfill	See Utilities Trench Backfill		
General Grading	Fill for abandoned or demolished structures	12”	95% D1557
	Fill in other locations not covered herein	12"	95% D1557

TYPE OF FILL	USAGE	LIFT THICKNESS	REQUIRED % OF MODIFIED PROCTOR TEST
	Topsoil placement	12”	95% D1557

F. "Influence area" shall be considered the area within lines sloped downward at 45 degrees from the outer edges of paving, foundations, and utility lines.

END OF SECTION

SECTION 02280

SOIL TREATMENT FOR TERMITE CONTROL

PART 1 – GENERAL

1.01 DESCRIPTION

Provide soil treatment for termite control as herein specified, under the Booster Pump Station Building. Provide soil treatment within hollow cells of all new concrete block cell walls.

1.02 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for the work, including preparation of substrate and application. Soil treatment methods shall be in accordance with the National Pest Control Association recommendations.

B. Engage a professional pest control company, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

1.03 SUBMITTALS

A. Product Data

Submit manufacturer's technical data and application instructions in accordance with Section 01300, "Submittals". Transmit a copy of the instructions to the Applicator.

B. Guarantee and annual renewal fee amount.

1.04 WARRANTY AND GUARANTEES

A. Furnish a written guarantee certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites, and that if subterranean termite activity is discovered during the guarantee period, the Contractor will re-treat the soil and also repair or replace damage caused by the termite infestation at no cost to the County.

B. Provide a guarantee for a period of one-year from the date of Project Substantial Completion. The guarantee shall be renewable by the County for an annual fee for as long as the building is in service.

PART 2 - PRODUCTS

2.01 MATERIALS

Soil Treatment Solution

A. Use an emulsible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent.

B. Provide a working solution of Dursban TC, 1.0 percent in water emulsion.

C. Other solutions may be used as recommended by the Applicator and if acceptable to local and federal governing authorities. Use only soil treatment solutions which are not injurious to planting.

PART 3 - EXECUTION

3.01 INSPECTION

Examine the areas and conditions under which soil treatment for termite control is to be applied. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 JOB CONDITIONS

A. Restrictions

1. Do not apply soil treatment solution outside the building limits. Contractor shall take precaution to not spray in the vicinity of the monitoring well.
2. Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. Penetration

To ensure penetration, do not apply soil treatment to excessively wet soils or during inclement weather. Comply with other handling and application instructions of the soil toxicant manufacturer.

3.03 APPLICATION

A. Surface Preparation

Remove foreign matter which could decrease the effectiveness of the treatment on areas to be treated. Toxicants shall be applied for placement of compacted fill under slabs. Immediately cover application area with a vapor barrier material after treatment.

B. Application Rates

Apply the soil treatment solution per the project label or, at a minimum, as follows:

1. Under slab-on-grade structures, treat the soil before the concrete slab(s) are poured using either a power sprayer or tank sprayers.
2. Apply one gallon of chemical solution per ten (10) square feet as an overall treatment under slabs and attached slab areas.
3. Apply four gallons of chemical solution per ten (10) linear feet per foot of depth from the bottom of the footer to grade around structure perimeters.
4. Apply two (2) gallons of chemical solution per ten (10) linear feet of concrete block hollow cells after placement of CMU.
5. Allow not less than twelve (12) hours for drying after application before beginning concrete placement or other construction activities.
6. Post signs in the areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.
7. Reapply soil treatment to areas disturbed by subsequent excavation or other construction activities following application.
8. Place a treatment sticker on the permit board after applications are complete.

END OF SECTION

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SECTION 02310

FINISH GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Topsoil placement and grading of site.

1.02 RELATED SECTIONS

Section 02230 - Site Preparation

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural topsoil typical of the area, free from subsoil, stones, plants, roots or other extraneous material and shall not be used while muddy or frozen.

B. Topsoil shall contain not less than 8% organic matter (AASHTO T194). The topsoil shall consist of either natural topsoils typical of the locality and free from coarse stone aggregate or surface soils stripped from the site and enriched with humus at a rate of 8% by volume. The soil mixture prepared by mixing surface soils and humus shall be free of oil, cinders, coarse stone, and woody root material.

PART 3 - EXECUTION

3.01 GENERAL

Provide all topsoil placement and finish grading and filling to achieve the lines and grades indicated on the Drawings. All earthwork shall be done in a manner that provides drainage.

3.02 TOPSOIL PLACEMENT

Place topsoil in all areas of new grading. The compacted subgrade to receive topsoil shall be scarified to a depth of 3 inches. Topsoil shall be spread evenly and compacted to a thickness of not less than 4 inches, 8 inches in areas to be grassed and planted, and to the proposed elevations and grades. Grade flush with walks, curbs, and paving.

3.03 FINISH GRADING

A. All areas of the project including all previously grassed areas that have been disturbed, borrow sites, excavated and filled sections and adjacent transition areas shall be uniformly smooth-graded. Depressions from settlement shall be filled and

compacted. Tops of embankments and breaks in grade shall be rounded. All surfaces shall be finished to provide adequate drainage. Finished surfaces shall be reasonably smooth, compacted, free from irregular surface changes and comparable to the smoothness obtained by blade-grader operations.

B. Slope grades to drain away from structures at a minimum of 3-inch per foot for 10 feet.

C. Finished surfaces adjacent to paved or surfaced areas and within 10 feet of structures shall be within 1 inch of the proposed grade. All other areas shall be within 3 inches of the proposed grade.

D. Newly graded areas shall be protected from traffic and erosion. All settlement or washing away that may occur from any cause prior to seeding or acceptance shall be repaired and grades re-established to the required elevations and slopes at no additional cost to the County.

E. Unless otherwise indicated, all surplus material shall be disposed of by the Contractor.

END OF SECTION

SECTION 02320

TRENCHING, BEDDING, AND BACKFILLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Trenching for piping and electrical work.

B. Excavation for manholes, junction boxes, meter vaults, and appurtenances.

C. Sheeting, shoring and bracing.

D. Bedding, backfilling, and compaction.

1.02 RELATED SECTIONS

A. Section 02230 - Site Preparation

B. Section 02250 - Compaction Control and Testing

C. Section 02310 - Finish Grading

D. Section 02370 - Erosion and Sedimentation Control

1.03 REFERENCES

A. AASHTO latest edition:
   1. AASHTO M145 - Classification of Soils
   2. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb Rammer and 18-in drop

B. ASTM latest edition:
   1. ASTM D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort
   2. ASTM D2487 - Classification of Soils for Engineering Purposes.

C. OSHA Regulations, including;

   Part 1926, Subpart P - Excavations

1.04 DEFINITIONS

A. Bedding: Area from bottom of trench to centerline of pipe

B. Backfill: Material above the top of pipe to the topsoil, paving sub-grade, or foundation level.

C. Influence Area: The area within lines sloped downward at 45° from the outer edges of paving, foundations, and utility lines.

1.05 QUALITY ASSURANCE

Field density testing frequencies: Refer to Section 02250.

PART 2 - PRODUCTS

2.01 GENERAL

It is intended that previously excavated materials conforming to the following requirements be utilized wherever possible.

2.02 MATERIALS

A. Suitable materials: AASHTO M145 classification A-1, A-3, A-2-4; ASTM D2487 classification GW, GP, SW, SP, SP-SM; unless otherwise disapproved within the Soil and Subsurface investigation reports. No more than 10% of acceptable materials shall pass the number 200 sieve.

B. Unsuitable materials: All materials other than those listed above.

C. Controlled low strength material ("flowable fill") shall meet the requirements of FDOT specification sections, except the range of acceptable 28-day compressive strength (as defined in 121-3) shall be revised to 75-100 psi.

2.03 SHEETING, SHORING, AND BRACING

A. The structural strength and safety of all sheeting, shoring and bracing shall be the sole responsibility of the Contractor. Repair any damage resulting from failure to provide adequate supports.

B. Provide timber work, shoring, bracing, sheeting, and sheet piling where necessary to retain banks of excavations, prevent cave-in of adjacent ground, prevent displacement of utilities and structures, and to protect public safety.

C. Contractor is solely responsible for the design, installation, and operation of dewatering systems and their safety and conformity with local codes and regulations.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION REQUIREMENTS

A. Provide suitable temporary drainage channels for any water that may flow along or across the work.

B. Provide barriers, warning lights and other protective devices at all excavations.

C. Sidewalks, roads, streets, and pavements shall not be blocked or obstructed by excavated materials, except as authorized by the Engineer, in which case adequate temporary provisions must be made for satisfactory temporary passage of pedestrians, and vehicles. Minimize inconvenience to public.

D. If open excavations cross existing rigid surfacing, the surfacing shall be removed for a width one foot beyond the anticipated edge of the excavation. The pavement break shall be sawed to insure a straight joint. Surface replacement shall match existing surfacing except as otherwise indicated on the Drawings. Where open excavation is allowed along or across public roadways, excavation, backfill, and surface replacement shall conform to the requirements of all permits applicable thereto. In no case shall surface replacement edges bear on less than 12 inches of undisturbed soil.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Locate and identify existing utilities that are to remain and protect from damage.

C. Notify utility companies to remove or relocate utilities that are in conflict with proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.03 SHEETING, SHORING, AND BRACING

A. Furnish, install, and maintain, without additional compensation, sheeting, bracing, and shoring support required to keep excavations within the easement provided, to support the sides of the excavation, and to prevent any movement which may damage adjacent pavements or structures, damage or delay the work, or endanger life and health. Voids outside the supports shall be immediately filled and compacted.

B. Sheeting, where required, shall be driven below the bottom of excavation so the lowest set of wales and struts are above the bottom of the excavation to allow necessary working room.

C. The County may direct in writing that supports in trenches be cut off at any specified elevation, in which case the Contractor shall be paid for the supports left in place.

D. Contractor may leave in place, to be embedded in the backfill of the excavation, any or all supports for the purpose of preventing injury to persons or property, whether public or private. However, no supports which are within 4' of the ground or

pavement surface may be left in place without written permission of the Engineer. No extra payment will be made for supports left in place at the Contractor's option.

E. All supports not left in place shall be removed in such manner as to avoid endangering the piping, structures, utilities or property, whether public or private. All voids left by the withdrawal of sheeting shall be immediately filled and compacted.

F. The right of the County to order supports left in place shall not be construed as creating an obligation on his part to issue such orders. Failure by the County to exercise this right shall not relieve the Contractor from total liability for damages to persons or property resulting from the failure of the Contractor to leave in place sufficient supports to prevent any caving or moving of the ground adjacent to the excavation.

3.04 TRENCHING

A. All excavations shall be made by open cut unless otherwise indicated. Sides of trenches shall be kept as nearly vertical as possible from the trench bottom to a level of one foot above the top of the pipe. Slope sides of trenches in accordance with OSHA requirements and recommendations contained within the geotechnical report.

B. Excavation of trenches shall not advance more than 50 feet ahead of completed pipe installation except as approved by the Engineer.

C. Excavate trenches to depth indicated or required for indicated flow lines and invert elevations. Over excavate trenches a minimum of 2 feet where excavations occur within unsuitable soils, and replace over excavated material with suitable soils.

D. Where rock is encountered, carry excavation 6 inches below scheduled elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.

E. For pipes or conduit 5 inches or less, excavate to indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

F. For pipes or conduit 6 inches or larger, and other work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6 inches below bottom of work to be supported.

G. Except as otherwise indicated, excavate for pressure piping so top of piping is minimum 3 feet below finished grade.

H. Unsuitable excavated materials shall be removed from the site and disposed, unless otherwise indicated on the Drawings.

I. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

J. Trench bottoms shall be kept dry, compacted, and stable to a depth two feet below the bottom of the trench.

K. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 9 -12 inch clearance on each side of pipe or conduit.

L. If more than one pipe is to be installed in a trench, the pipes shall be spaced a minimum of one foot apart for pipes 4 inches and larger.

M. If portions of the bottom of trenches consist of material unstable to such a degree that, in the opinion of the Engineer, it cannot adequately support the pipe or structure, the bottom shall be over-excavated and stabilized with approved coarse granular stabilization material. Depth of stabilization shall be as directed by the Engineer. The initial 10 tons of stabilization shall be incidental to the Contract. Compensation will be allowed only for such additional quantities as the Engineer shall direct in writing to be placed.

N. Do not backfill trenches until tests and inspections have been made.

3.05 TRENCH BACKFILLING

A. Following placement of pipe and inspection of joints, install tamped bedding material. Place bedding fill materials in layers of 6-inch loose depth.

B. All bedding and backfill material shall be suitable soils or flowable fill. Backfill material within 1 foot of pipe and appurtenances shall not contain rock or stone larger than 2-inch diameter. If a sufficient quantity of suitable material is not available from the trench or other excavations within the site, provide additional suitable material or flowable fill.

C. After completion of bedding and preliminary approval of piping and testing, the pipe shall be covered to a point one foot above the top of the pipe for the full trench width, placed in layers of 6-inch loose depth.

D. Place backfill over pipe. Where trench is within the influence area of roadways, structures, foundations, or slabs, place backfill in layers of 6-inch loose depth. In all other areas, place backfill in layers of 8-inch loose depth.

E. Take necessary precautions not to cause settlement or damage to adjacent slabs, walls, structures, or foundations. Place backfill and fill materials evenly adjacent to structures, without wedging against structures or displacement of piping or conduit.

3.06 MINOR STRUCTURAL EXCAVATION AND BACKFILLING

A. Minor structures are defined as manholes, junction boxes, inlets, valve vaults, and meter vaults. Do not excavate for any structure until that structure is scheduled for construction. Excavate only to the depth and dimensions necessary for the construction.

B. The bottom of all excavations shall be undisturbed earth unless otherwise indicated, and shall be approved by the Engineer before any subsequent work is started.

C. Excavations carried below depths indicated on the Drawings without the previous approval of the County shall be filled with 2,500-psi concrete or flowable fill to the correct level at the expense of the Contractor.

D. Maintain excavations in good order. If the bearing capacity of the foundation soils is reduced because the excavation is allowed to remain open prior to commencing work, the weathered soil shall be removed and replaced with 2,500 psi concrete or flowable fill at the expense of the Contractor.

E. Do not backfill until new concrete has properly cured, coatings have been approved, and any required tests have been accepted.

F. Exercise care during backfilling operations to avoid any puncture, break or other damage to waterproofing systems, if any. Backfill adjacent to waterproofing in the presence of the County.

G. Where backfilling is required on both sides of structures, backfill and compact simultaneously on opposite sides in even layers. Other backfilling sequences shall be as specifically noted.

3.07 COMPACTION

A. Unless otherwise indicated, the type of equipment and number of passes required to obtain the specified degree of compaction shall be determined at the site, subject to the approval of the County.

B. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the County. Vibratory compaction is not allowed within 100 feet of existing structures. In these areas, compaction shall be accomplished by static means only. If compaction difficulties arise, the County shall be consulted to review and possibly modify compaction procedures.

C. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated.

D. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.08 TESTING AND CLEANUP

A. Provide for testing and cleanup as soon as practicable, so these operations do not lag far behind pipe installation. Perform preliminary cleanup and grading operations immediately after backfilling.

B. All surplus excavated material shall be disposed of by the Contractor.

3.09 FIELD QUALITY CONTROL

Minimum Density Requirement

See Section 02250 for minimum density requirements.

END OF SECTION

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SECTION 02370

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

Designing, providing, maintaining, removing temporary erosion and sedimentation controls.

1.02 RELATED SECTIONS

A. Section 01415 – Stormwater Pollution Prevention/NPDES Requirements

B. Section 02230 – Site Preparation

C. Section 02240 - Dewatering

D. Section 02230 - Trenching, Bedding, and Backfilling

1.03 REFERENCES

Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction and Roadway and Traffic Design Standards, latest editions:

A. Specification No. 104 – Prevention, Control, and Abatement of Erosion and Water Pollution

B. Specification 300 - Prime and Tack Coats for Base Courses

1.04 SUBMITTALS

Provide erosion control plan. Show types of erosion and sedimentation control, locations, inspection and maintenance plan.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Seeding and Mulching

B. Sodding

C. Hydro-seeding

D. Coarse Aggregate

E. Prime Coat - Per FDOT Specification 300

2.02 SEDIMENTATION CONTROL

A. Per FDOT Specification No. 104 – Prevention, Control, and Abatement of Erosion and Water Pollution

PART 3 - EXECUTION

3.01 EROSION CONTROL

A. Establish erosion control measures within 48 hours of the completion of any clearing and grading activities.

B. Erosion control of areas to be paved shall meet the following:

1. Install subgrade and base course materials within 48 hours of the completion of grading activities.

2. Areas to receive asphalt shall receive erosion control measures no later than 48 hours after acceptance of base course. Temporary erosion control consists of placement of a bituminous prime coat and sanding the surface. Permanent erosion control consists of placement of the structural course.

3. Areas to receive concrete paving shall be either protected with a layer of FDOT coarse aggregate material or shall be paved within 48 hours of acceptance of the subgrade.

3.02 SEDIMENTATION CONTROL

A. Install prior to construction.

B. Inspect every two weeks during construction.

C. Remove any sediment build-up.

D. Repair and reinstall any damaged or missing sediment control measures. Install additional measures if inspection reveals additional sedimentation control is necessary.

E. Rough excavate and grade any proposed stormwater ponds at the start of site grading activities. Direct site runoff to the ponds to minimize runoff to offsite areas.

END OF SECTION

SECTION 02570
STABILIZED SUBGRADE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: All labor, materials, and equipment required to install stabilized subgrade.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:
   1. AASHTO T-180 – Moisture-Density Relations of Soils Using a 10-lb Rammer and 18-in Drop

B. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition:
   1. Section 914 – Stabilization Materials

1.03 QUALITY ASSURANCE

A. Field compaction density, stability, and thickness testing frequencies of the subgrade shall be tested once every 300 linear feet of paving per 24-foot wide strip, staggered left, center, and right of centerline. Where less than 300 linear feet of asphalt is placed in 1-day, provide minimum of 1 test for each per day's construction at a location designated by the County.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
   1. Materials certificates signed by material producer and Contractor, certifying that each material item complies with specified requirements.

1.05 SYSTEM DESCRIPTION

A. Stabilize the roadbed below the proposed base to provide a firm and unyielding subgrade.

B. Provide a finished roadbed section that meets the bearing value requirements regardless of the quantity of stabilizing materials necessary to be added.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications, which is provided in **Appendix 3** of these technical specifications for reference.

B. The Contractor may choose the type of stabilizing material.

C. Materials may be lime rock, shell rock, cemented coquina, or shell-base sources approved by the FDOT.

D. At least 97% by weight of the total material shall pass a 3-1/2-inch (90-mm) sieve. Material having a plasticity index greater than 10 or a liquid limit greater than 40 shall not be used as a stabilizer.

2.02 LIMEROCK

A. For limerock, carbonates of calcium and magnesium shall be at least 70%.

2.03 CRUSHED SHELL

A. Crushed shell for this use shall be mollusk shell (i.e., oysters, mussels, clams, cemented coquina). Steamed shell will not be permitted.

B. At least 50% by weight of the total material shall be retained on the No. 4 (4.75 μm) sieve.

C. Not more than 20% by weight of the total material shall pass the No. 200 (75 μm) sieve. The determination of the percentage passing the No. 200 (75 μm) sieve shall be by washing only.

2.04 LOCAL MATERIALS

A. Local materials used for this stabilizing may be soils or recyclable materials such as crushed concrete, roof tiles, asphalt coated base, or reclaimed pavement. However, no materials that deteriorate over time, cause excessive deformations, contain hazardous substances, contaminates, or do not improve the bearing capacity of the stabilized material may be used.

PART 3 - EXECUTION

3.01 GENERAL

A. Prior to the beginning of stabilizing operations, construct the area to be stabilized to an elevation such that, upon completion of stabilizing operations, the completed stabilized subgrade will conform to the lines, grades, and cross-section shown in the plans. Prior to spreading any additive stabilizing material, bring the surface of the roadbed to a plane approximately parallel to the plane of the proposed finished surface.

B. Process the subgrade to be stabilized in 1 course, unless the equipment and methods being

used do not provide the required uniformity, particle size limitation, compaction, and other desired results, in which case, the County will direct that the processing be done in more than 1 course.

3.02 APPLICATION OF STABILIZING MATERIAL

A. When additive stabilizing materials are required, spread the designated quantity uniformly over the area to be stabilized.

B. When materials from an existing base are to be used in the stabilizing at a particular location, place and spread all of such materials prior to the addition of other stabilizing additives.

C. Spread commercial stabilizing material by the use of mechanical material spreaders, except that where use of such equipment is not practicable, use other means of spreading, but only upon written approval of the proposed alternate method.

3.03 MIXING

A. Perform mixing using rotary tillers or other equipment meeting the approval of the County. The Contractor may mix the materials in a plant of an approved type suitable for this Work. Thoroughly mix the area to be stabilized throughout the entire depth and width of the stabilizing limits.

B. Perform the mixing operations as specified (either in place or in a plant) regardless of whether the existing soil, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.

3.04 MAXIMUM PARTICLE SIZE OF MIXED MATERIALS

A. At the completion of the mixing, ensure that the gradation of the material within the limits of the area being stabilized is such that 97% will pass a 3-1/2-inch sieve and that the material does not have a plasticity index greater than 8 or liquid limit greater than 30. Note that clay balls or lumps of clay size particles (2 microns or less) cannot be considered as individual particle sizes. Remove any materials not meeting the plasticity requirements from the stabilized area. The Contractor may break down or remove from the stabilized area materials not meeting the gradation requirements.

3.05 COMPACTION

A. Compact the materials at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either add water or allow the material to dry until reaching the proper moisture content for the specified compaction.

3.06 FINISH GRADING

A. Shape the completed stabilized subgrade to conform to the finished lines, grades, and cross-section indicated in the Drawings. Check the subgrade using elevation stakes or other means approved by the County.

3.07 CONDITION OF COMPLETED SUBGRADE

A. After completing the stabilizing and compacting operations, ensure that the subgrade is firm and substantially unyielding to the extent that it will support construction equipment and will have the bearing value required by the Drawings.

B. Remove all soft and yielding material, and any other portions of the subgrade that will not compact readily. Replace yielding material with suitable material so that the whole subgrade is brought to line and grade with proper allowance for subsequent compaction.

3.08 MAINTENANCE OF COMPLETED SUBGRADE

A. After completing the subgrade, maintain it free from ruts, depressions, and any damage resulting from the hauling or handling of materials, equipment, and tools. The Contractor is responsible for maintaining the required density until the subsequent base or pavement is in place including any repairs or replacement of curb and gutter or sidewalk which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Perform any such recompaction at no expense to the County. Construct and maintain ditches and drains along the completed subgrade section.

3.09 FIELD QUALITY CONTROL

A. When proper moisture conditions are attained, compact the material to not less than 98% of maximum density determined by AASHTO T-180, and a minimum LBR of 40.

END OF SECTION

SECTION 02572

SOIL CEMENT BASE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish and install base course using a combination of soil, Portland cement, and water.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:
   1. AASHTO T-88: Particle Size Analysis of Soils
   2. AASHTO T-89: Determining the Liquid Limit of Soils
   3. AASHTO T-90: Determining the Plastic Limit and Plasticity Index of Soils
   4. AASHTO T-134: Moisture-Density Relations of Soil-Cement Mixtures
   5. AASHTO T-135: Wetting and Drying Test of Compacted Soil-Cement Mixtures
   6. AASHTO T-267: Determination of Organic Content in Soils by Loss on Ignition

B. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest implemented edition:
   1. Specification Section 911: Limerock Material for Base and Stabilized Base
   2. Specification Section 916: Bituminous Materials
   3. Specification Section 921: Portland Cement and Blended Cement

1.03 QUALITY ASSURANCE

A. For density and thickness determination, a LOT is defined as 2,500 square yards of base, plus any small section of base at the end of a day's operation in the preceding LOT. The County may include small irregular areas as part of another LOT. Areas such as an intersection, crossover, and ramp will be considered as a separate LOT. No LOT shall include more than 3,500 square yards or it shall be considered as a separate LOT.

B. Five (5) density tests shall be performed at locations randomly selected by the County within each LOT.

C. Five (5) thickness measurements shall be performed at locations randomly selected by the County within each LOT. Three-inch minimum diameter test holes are required to determine the thickness.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
   1. Soil-cement design mix

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications, which is provided in **Appendix 3** of these technical specifications for reference..

2.02 MATERIALS

A. Cement shall be Portland cement, Type I, II, III, or Type 1-P per FDOT Specification Section 921.

B. Use water that is free from substances deleterious to hardening of the soil-cement mixture.

C. Curing Material shall be per FDOT Specification Section 916.

D. Emulsified asphalt shall be Grade SS, RS, or MS as approved by the County. Dilute as recommended by the manufacturer.

E. Soils for base course construction shall be either limerock material per FDOT Specification Section 911 or soils meeting the following requirements:

Table 02572-1
Soil Requirements

Physical Characteristic	Acceptance Level	Testing Standard
Organic Material	Maximum 5%	AASHTO T-267
Total Clay and Silt Content (Minus No. 200 Sieve)	Maximum 25%	AASHTO T-88
Plastic Index	Maximum 10%	AASHTO T-90
Liquid Limit	Maximum 25%	AASHTO T-89

Table 02572-2
Soil Gradation Requirements

Soil Gradation Requirements (Per AASHTO T-88)	
Passing 2-inch sieve	Minimum 100%
Passing No. 4 sieve	Minimum 55%
Passing No. 10 sieve	Minimum 37%

2.03 PROPORTIONING OF MIX

A. Submit for approval a design mix for the soil proposed for use in soil-cement construction prepared by a testing laboratory approved by the County. The design mix submittal shall

include the results of tests run to verify that the soil meets the requirements; results of tests used to establish the cement content; and a final design laboratory sample. Submit the design mix to the County for approval a minimum of 60-calendar days prior to beginning of soil-cement construction for Brush Loss Design Method or 15-calendar days prior to beginning of soil-cement construction for Strength Design Method. Express the cement as a percentage of the dry unit weight of the soil. For mixed-in-place construction, use a ratio of cement based on the maximum density of the soil determined in accordance with AASHTO T-99 and rounded up to the nearest pound per cubic yard.

B. When proportioning the soil-cement mixture in accordance with strength design, determine the minimum cement content using FM 5-520. The design compressive strength specified shall be achieved in 7-days. Ensure that the cement content is not less than 5% by weight except as noted below.

C. When proportioning the soil-cement mixture in accordance with Brush Loss Design criteria, determine the minimum cement content in accordance with AASHTO T-135. Ensure that the cement content is not less than 5% by weight except as noted below. Ensure that the soil-cement loss at the completion of 12 cycles of testing conforms to the limits in the following table.

Table 02572-3
Soil Limits

Soil Group	Limits
AASHTO Soils Groups A-1, A-2-4, A-2-5, and A-3	Not over 14%
AASHTO Soils Groups A-2-6, A-2-7, A-4, and A-5	Not over 10%
AASHTO Soils Groups A-6 and A-7	Not over 7%

D. When proportioning of soil-cement mixture by the Brush Loss Design Criteria Method and processing by Central-Plant-Mixing where the requirements noted below are met, the County will not require strength testing of field specimens. Verify the properties of the parent material during the processing, on a random frequency, to ensure that the final mix has not changed from the original design. Provide the County a printout of each day's production that shows proportioning of the mixture meets the approved Brush Loss Design, including cement.

E. Do not apply the minimum 5% cement content specified above if obtaining the soil material used in producing a soil-cement mixture from a commercial source (not to exclude recycled materials) where soil properties are consistently uniform, and if processing the mixture in a central mix plant that automatically weighs components and automatically records the weight of each component on a printed ticket, tape, or other digital record.

PART 3 - EXECUTION

3.01 GENERAL

A. Use any machine, combination of machines, or equipment that is in good, safe working condition and that will produce results meeting the requirements for cement application, soil pulverization, mixing water application, compaction, finishing, and curing, as required herein. Compaction equipment shall be used that will produce a base at the required density.

3.02 SUBGRADE PREPARATION

A. Subgrade shall be completed before beginning base construction operations. Ensure that the subgrade is firm enough to support the equipment used in the soil-cement base operations without appreciable distortion or displacement. Remove any unsuitable material and replace it with suitable material.

B. When constructing the base with central-plant-mixed soil-cement, grade and shape the subgrade to the lines, grades, and typical cross-section shown in the plans. Ensure that the subgrade is moist but not ponded at the time of placing the mixed base course material.

3.03 BASE SOIL FOR MIXED-IN-PLACE PROCESSING

A. Grade and shape the area over which the base is to be constructed to an elevation that will provide a base in conformance with the grades, lines, thickness, and typical cross-sections shown on the plans. Remove all roots, sticks, and other deleterious matter during processing.

3.04 PROCESSING OF SOIL-CEMENT MIXTURE

A. Mix the soil, cement, and water either by mixed-in-place or central-plant-mix methods.

B. Do not allow the percentage of moisture in the soil at the time of cement application to exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations.

C. During seasons of freezing temperature, do not spread any cement or soil-cement mixture unless the ambient temperature is at least 40°F in the shade.

D. At the completion of moist-mixing, pulverize the soil so that 100% passes a 1-1/2-inch sieve, 95 to 100% passes the 1-inch sieve and a minimum of 80% passes a No. 4 sieve, exclusive of gravel, shell, or stone.

E. Operations shall be completed within a period of 4-hours starting at the time mixing commences.

3.05 MIXED-IN-PLACE METHOD

A. Where feasible, process the entire width of the base in a single operation. Uniformly spread the design quantity of cement on the soil at the required rate of application, by means of an approved method. Replace spread cement that becomes displaced before starting mixing.

Check the uniformity of spread rate by:

1. Weight of cement spread/square yards covered for a short trial section that is between 100 and 300-feet in length; or
2. Use of a square yard cloth/box

B. After applying the cement, begin mixing within 60-minutes. Initially mix the soil and cement until the cement has sufficiently blended with the soil to prevent formation of cement balls when applying additional water; then add water if necessary, and re-mix the soil-cement mixture. Do not perform windrow mixing.

C. Process up to the full depth in 1 course, provided the distribution of cement and water and the specified density are satisfactory to the County. If not, construct courses of such thickness to obtain satisfactory results. Make provisions to achieve adequate bonding between courses.

D. Immediately after mixing of the soil and cement, add any additional water that is necessary. If the moisture content exceeds that specified, manipulate the soil-cement mixture by re-mixing or grading as required to reduce the moisture content to within the specified range. Avoid excessive concentrations of water. Continue mixing during and after applying water until obtaining a uniform mixture of soil, cement, and water.

E. As an alternative to the above-described procedure, the Contractor may use an approved machine that will blend the cement and the soil. Additional water may be added and mixed as necessary.

3.06 CENTRAL-PLANT-MIXED METHOD

A. Mix the soil, cement, and water in a pugmill of either the batch or continuous-flow type. Equip the plant with feeding and metering devices that will accurately proportion the soil, cement, and water in the quantities specified. Mix soil and cement sufficiently to prevent cement balls from forming when adding additional water. Continue mixing until obtaining a uniform mixture of soil, cement, and water.

B. Haul the mixture to the roadway in trucks equipped with protective covers. Place the mixture on the moistened subgrade in a uniform layer with suitable equipment. Do not allow more than 60-minutes to elapse between placing of soil-cement in adjacent passes of the spreader at any location, except at construction joints. Ensure that the layer of soil-cement is uniform in thickness and surface contour and in such quantity that the completed base will conform to the required grade and cross-section. Do not perform windrow mixing.

3.07 CONSTRUCTION JOINTS

A. Prior to joining any previously constructed section of base, form a vertical construction joint by cutting back into the completed work to form a true vertical face of acceptable soil-cement to the full depth of the base course. Moisten the vertical face as needed prior to placing new material against it.

3.08 SHAPING AND FINISHING

A. Prior to final compaction, shape the surface of the soil-cement to the required lines, grades,

and cross-section. In all cases where adding soil-cement mixture to any portion of the surface, lightly scarify the surface with a spring tooth harrow, spike drag, or other approved device to uniformly loosen the surface prior to adding material and prior to the initial set of the soil-cement mixture. Compact the resulting surface to the specified density. Continue rolling until all rutting ceases and until the base conforms to the density requirements.

B. Ensure that the surface material is moist but not ponded, and maintained at not less than 2% below its specified optimum moisture content, during finishing operations. Perform surface compaction and finishing in such a manner as to produce a smooth dense surface, free of compaction planes, construction cracks, ridges, and loose material.

C. If the time limits specified above are exceeded, either remove and replace the base or leave the base undisturbed for a period of 7-days, after which, the County will examine it to determine its suitability. If found unsuitable, remove and replace the base at no additional cost to County.

3.09 COMPACTION

A. Begin compacting the soil-cement mixture immediately after mixing or placing. Do not allow more than 30-minutes to elapse between the last pass of moist-mixing or spreading and the start of compaction of the soil-cement mixture at a particular location.

B. Determine the optimum moisture content and the maximum density in the field by the methods prescribed in AASHTO T-134 on representative samples of the soil-cement mixture obtained immediately after the initial mixing. Determine the density for each day's run or change of material.

C. Uniformly compact the loose material to meet the density requirements specified below. During compaction operations, reshape the material to obtain required grade and cross-section.

3.10 PROTECTION AGAINST DRYING

A. While finishing and correcting the surface, keep the surface of the base continuously moist by sprinkling water as necessary until applying the emulsified asphalt curing material. As soon as practicable, protect the base from drying for 7-days by applying the emulsified asphalt at the rate of 0.20 to 0.25-gallons of the diluted mixture per square yard. Provide complete coverage without excessive runoff. While applying the bituminous material, ensure that the soil-cement surface is dense, free of all loose and extraneous material, and contains sufficient moisture to prevent excessive penetration of the bituminous materials.

B. If it is necessary to allow construction equipment or other traffic to use the completed base before the bituminous material has cured sufficiently to prevent pickup or displacement, sand the bituminous material, using approximately 10-lbs of clean sand per square yard. Do not use cover material containing organic acids or other compounds detrimental to the soil-cement base.

C. Maintain the curing material during the 7-day protection period.

3.11 OPENING TO TRAFFIC

A. Do not allow traffic on the base subsequent to completion of the finishing operations for a minimum period of 72-hours. As an exception to this requirement, allow equipment necessary for correction of surface irregularities, application of water, and application of curing materials on the base, if the tire contact pressures of such equipment do not exceed 45-psi. Under special conditions (i.e. low speed limit, low traffic volume, urban conditions), the County may waive the 72-hour period.

3.12 MAINTENANCE

A. Maintain the base to a true and satisfactory surface until the wearing surface is constructed. If the County requires any repairing or patching, extend the repair or patch to the full depth of the base, and make them in a manner that will ensure restoration of a uniform base course in accordance with the requirements of these Specifications. Do not repair the base by adding a thin layer of soil-cement or concrete to the completed work. Make full depth repairs to small or minor areas, such as at manholes or inlets, with Class I concrete.

B. For patching of deficient areas less than 100-square feet and less than 1-inch in depth, correct the areas using Type S-III Asphalt Concrete. For patching of deficient areas less than 100-square feet and greater than 1-inch in depth, remove the areas to full depth and replace them using Asphalt Base Course Type 3, Type S Asphaltic Concrete, or soil-cement.

3.13 DENSITY TESTING REQUIREMENTS

A. As soon as possible after completing compaction, perform field density testing to ensure that the density is 97% of the maximum density as determined by methods prescribed in AASHTO T-134.

B. If an individual test value within a LOT is less than 94% of the maximum density, determine the extent of this deficiency by performing density tests using a 5-foot grid pattern until a test value of 95% or greater is located in all directions. Remove the delineated area of base, and replace it with base meeting all requirements of this section, at no cost to the County.

C. As an exception to the foregoing, if 3 or more of the original 5 individual test values within a LOT are less than 94% of the maximum density, the County will reject the entire LOT, and the Contractor shall remove all base within the LOT and replace it with base meeting all requirements of this Section, at no expense to the County.

3.14 SURFACE FINISH ACCEPTANCE REQUIREMENTS

A. After compacting and finishing, and not later than the beginning of the next calendar day after constructing any section of base, measure the surface with a template cut to the required cross-section and a 15-foot straightedge placed parallel to the centerline of the road. Both templates shall be provided by the Contractor. Correct all irregularities greater than 1/4-inch to the satisfaction of the County with a blade adjusted to the lightest cut which will ensure a surface that does not contain depressions greater than 1/4-inch under the template or the straightedge. The County may approve other suitable methods for measurement.

3.15 THICKNESS ACCEPTANCE REQUIREMENTS

A. Construction tolerances for thickness are as follows:

Table 02572-4
Thickness Tolerances

	Allowable Deviation From Plan Thickness
Central-Plant-Mixed Processing	-1-inch
Mixed-in-Place Processing	+/- 1-inch

B. When any thickness measurement is outside the construction tolerance, the County will take additional thickness measurements at 10-foot intervals parallel to the centerline in each direction from the measurement which is outside the construction tolerance until a measurement in each direction is within the construction tolerance.

C. The County will evaluate an area of base found to have a thickness outside the construction tolerance and may require the Contractor to remove and replace it with acceptable base of the thickness shown in the plans at no expense to the County.

3.16 STRENGTH TESTING OF FIELD SPECIMENS

A. Check the adequacy of cement content and uniformity of distribution of cement within the base by sampling and testing the completed mix.

B. Take samples at the project site just prior to final compaction and perform a minimum of 2 Strength Test Values (STV) each day, with at least 1 STV per each 2,500 square yards mixed.

C. Ensure that each STV is the average strength value of a minimum of 3 individual specimens.

D. Take representative samples of the mixed soil-cement material for determining an STV just prior to final compaction, recording the sample location, and ensuring that the samples are large enough to mold 3 or more compressive strength test specimens as prescribed in FM 5-520.

E. Mold test specimens at the field moisture content and cast the individual test specimens as close to identical as possible

F. Rest the molds during compaction of strength test specimens on a 200-pound concrete block that the Contractor provides.

G. Gently extrude these test specimens from the compaction mold, and carefully place them in a moist curing environment (not in direct contact with water) such as a tightly closed container under wet cloth or burlap at locations where they will not be disturbed.

H. Continue the initial field cure for at least 24-hours, and if after 24-hours it is determined that the specimens have not gained sufficient strength to be moved without probable damage, continue field curing until the County determines that each specimen can be safely moved without probable damage occurring. When the County determines that the specimens can be

safely moved, transport them to the laboratory where they will be cured, as described in the design procedure (FM 5-520), to 7-days of age. At 7-days of age, test the individual specimen for determination of compressive stress and ensure that the loading procedure and rates are the same, as described in FM 5-520.

I. If an STV is less than 60% of the Laboratory Design Strength, remove and replace the material represented by the STV, at no expense to the County.

J. When the LOT average thickness of soil-cement base is deficient by more than 1-inch and the judgment of the County is that the area of such deficiency should not be removed and replaced, payment for the area retained will be at 50%.

K. When multiple deficiencies occur, the applicable percent payment schedule will be applied to the LOT of base that is identified with each deficiency. The penalty for each deficiency will be applied separately to the unit price.

END OF SECTION

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SECTION 02573
ASPHALT PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Install asphalt paving on a prepared base, provide pavement striping and markings.

1.02 REFERENCES

A. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, 2000 and 2004 editions.
   1. Section 300 – Prime and Tack Coats for Base Courses (2000 and 2004 Editions)
   2. Section 320 – Hot Bituminous Mixtures – Plant, Methods, and Equipment (2000 and 2004 Editions)
   3. Section 327 – Milling of Existing Asphalt Pavement (2000 and 2004 Editions)
   4. Section 330 – Hot Bituminous Mixtures – General Construction Requirements (2000 and 2004 Editions)
   5. Section 331 – Type S Asphalt Concrete (2000 Edition)
   6. Section 334 – Superpave Asphalt Concrete (2004 Edition)
   7. Section 901 – Coarse Aggregate (2000 and 2004 Editions)
   8. Section 902 – Fine Aggregate (2000 and 2004 Editions)
   9. Section 916 – Bituminous Materials (2000 and 2004 Editions)
   10. Section 917 – Mineral Filler (2000 and 2004 Editions)

B. Florida Department of Transportation (FDOT) Design Standards, 2000 and 2004 editions.

1.03 QUALITY ASSURANCE

A. Asphalt pavements shall be plant-mixed hot bituminous mixtures. Plant operations shall not begin unless all weather conditions are suitable for laying operations. A prime and tack coat shall be first applied to newly constructed bases. A tack coat shall be applied on existing pavements that are to be overlayed with an asphalt mix and between successive layers of asphalt mix. Apply prime and tack coats when ambient or base surface temperature is above 40°F, and when temperature has been above 35ºF for 12-hours immediately prior to application. Construct asphaltic concrete paving when ambient temperature is above 45°F. Do not apply when base is wet, contains excess moisture, or during rain. Establish and maintain required lines and elevations.

B. Do not spread the mixture when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved to the extent that the bond between layers will be diminished.

C. Field compaction density and thickness testing frequencies of the asphalt shall be tested once every 300-linear feet of paving per 24-foot wide strip, staggered left, center, and right of

centerline. Where less than 300-linear feet of asphalt is placed in 1-day, provide minimum of 1 test for each per day's construction at a location designated by the County.

D. Asphalt extraction gradation shall be tested from grab samples collected once every 1,800-square yards of asphalt delivered to the site, or a minimum of once per day. Obtain the results in a timely manner (no later than the end of the day) so that adjustments can be made if necessary.

E. On initial use of a Type S mix design at a particular plant, as a minimum, run an additional extraction gradation analysis if more than 500-tons [450-metric tons] of mixture are produced on the first day of production.

F. Tolerances for Quality Control Tests (Extraction Gradation Analysis) shall be in accordance with FDOT Specification Section 331.

1.04 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
   1. Submit for each proposed design mix the Gradation analysis; Grade of asphalt cement used; and Marshall Stability in pounds flow.
   2. Provide a single percentage of asphalt by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1%. For structural mixes (S-1, S-3) establish the optimum asphalt content at a level corresponding to a minimum of 4.5% air voids. Provide the laboratory density of the asphalt mixture for all mixes except Open-Graded Friction Courses.
   3. Identify source and description of the materials to be used.
   4. Provide certification that the mix design conforms to specification requirements.
   5. Field compaction density and thickness testing.
   6. Field asphalt extraction gradation.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications, which is provided in **Appendix 3** of these technical specifications for reference.

B. Type S-1 Asphalt Concrete is required. The equivalent Type SP-12.5 (Superpave) Asphalt Concrete mixture meeting the requirements of FDOT Specification Section 334 may be selected as an alternate at no additional cost to the County.

C. Asphalt plant and equipment shall meet the requirements in FDOT Specification Section 320.

2.02 AGGREGATE

A. Coarse Aggregate, Stone, Slag, or Crushed Gravel shall meet the requirements in FDOT Specification Section 901.

B. Fine Aggregate shall meet the requirements in FDOT Specification Section 902.

C. Aggregate gradation shall meet the following:

Table 02573-1
Bituminous Concrete Mixtures
(Gradation Design Range)

Type	Total Aggregate Passing Sieves1							
	3/4-inch [19.0 mm]	1/2-inch [12.5 mm]	3/8-inch [9.5 mm]	No. 4 [4.75 mm]	No. 10 [2.0 mm]	No. 40 [425 µm]	No. 80 [180 µm]	No. 200 [75 µm]
S-1[4]	100	88-98	75-93	47-75	31-53	19-35	7-21	2-6
S-3[4]		100	88-98	60-90	40-70	20-45	10-30	2-6
ABC-1		100						0-12
ABC-2		100			55-90			0-12
ABC-3[2]	70-100			30-70	20-60	10-40		2-10
FC-2[3]		100	85-100	10-40	4-12			
FC-3[4]		100	88-98	60-90	40-70	20-45	10-30	2-6

1. In inches [mm] or sieves [µm].
2. 100% passing 1-1/2-inch [37.5 mm] sieve.
3. The County may increase the design range for the No. 10 [200 mm] sieve for lightweight aggregates.
4. The County may retain up to 1% on the maximum sieve size.

D. Use clean aggregate containing no deleterious substances. Do not use coarse or fine aggregate which contains more than 0.5% of phosphate.

E. In laboratory tests, and for the purpose of proportioning the paving mixture, consider all material passing the No. 10 [2.00-mm] sieve and retained on the No. 200 [75 µm] sieve as fine aggregate, and the material passing the No. 200 [75 µm] sieve as mineral filler.

F. Do not use any screenings in the combination of aggregates containing more than 15% of material passing the No. 200 [75 µm] sieve. When two screenings are blended to produce the screening component of the aggregate, one of such screenings may contain up to 18% of material passing the No. 200 [75 µm] sieve, as long as the combination of the two does not contain over 15% material passing the No. 200 [75 µm] sieve. Screenings may be washed to meet these requirements.

2.03 ASPHALT CEMENT

A. Superpave PG Asphalt Binder or Recycling Agent shall meet the requirements in FDOT Specification Section 916.

B. Mineral Filler shall meet the requirements in FDOT Specification Section 917.

C. Marshall design mix shall be in accordance with the following:

Table 02573-2
Marshall Design Properties For Bituminous Concrete Mixes

Mix Type	Minimum Marshall Stability (lbs.)	Flow* (0.01 in)	Minimum VMA (%)	Air Voids (%)	Minimum Effective Asphalt Content (%)	VFA Voids Filled with Asphalt (%)
S-1	1,500	8-13	14.5	4-5	**	65-75
S-3	1,500	8-13	15.5	4-6	**	65-75
ABC-1	500	7-15	15	5-16	6.0	-
ABC-2	750	7-15	15	5-14	5.5	-
ABC-3	1,000	8-13	14	4-7	**	65-78
FC-2	-	-	-	-	-	-
FC-3	1,500	8-13	15.5	4-6	**	65-75

* The maximum Flow value during production shall not exceed one point more than shown in the Table.
** The ratio of the percentage by weight of total aggregate passing the No. 200 sieve to the effective asphalt content expressed as a percentage by weight of total mix shall be in the range of 0.6 to 1.2.

2.04 BITUMINOUS MIXTURE

A. Use a bituminous mixture composed of a combination of aggregate (coarse, fine or mixtures thereof), mineral filler, if required, and bituminous material. Ensure that no more than 20% by weight of the total aggregate used is silica sand or local materials as defined in FDOT Specification Section 902. Size, grade, and combine the several aggregate fractions in such proportions that the resulting mixture meets the grading and physical properties of the verified mix design.

PART 3 - EXECUTION

3.01 GENERAL

A. Set up, install and maintain temporary traffic control devices and detours as necessary in accordance with Specification Section 1570 "Maintenance of Traffic."

B. Asphalt pavements, including all surface courses and base courses, where shown to be open cut and removed on the Drawings or specified in the Project Manual, shall be removed to a line back from each edge of the trench, other excavation, or to the limits indicated on the Drawings. Pavements shall be cut straight, clean and square with a power saw or other tools and equipment suitable for the Work.

C. Asphalt pavements, where shown to be milled on the Drawings or specified in the Project Manual, shall be milled according to FDOT Specification Section 327.

D. Asphalt mixtures shall meet the general construction requirements specified in FDOT Specification Section 330.

E. Spread the mixture only when the surface upon which it is to be laid has been previously prepared, is intact, firm, and properly cured, and is dry. Do not spread mixture that cannot be finished and compacted during daylight hours.

F. Deliver the asphalt cement from the asphalt plant at a temperature not to exceed 350°F and

equip the transport tanks with sampling and temperature sensing devices meeting the requirements of FDOT. Maintain the asphalt cement in storage within a range of 230°F to 350ºF in advance of mixing operations. Maintain constant heating within these limits, and do not allow wide fluctuations of temperature during a day's production.

G. Produce a homogeneous mixture, free from moisture and with no segregated materials, that meets all specification requirements for the mixture, including compliance with the Marshall Properties. Also apply these requirements to all mixes produced by the drum mixer process and all mixes processed through a hot storage or surge bin, both before and after storage.

3.02 PREPARATION OF APPLICATION SURFACES

A. Prior to the laying of the mixture, clean the surface of the base or pavement to be covered of all loose and deleterious material by the use of power brooms or blowers, supplemented by hand brooming where necessary.

B. Where an asphalt mix is to be placed on an existing pavement or old base that is irregular, and wherever the plans indicate, bring the existing surface to proper grade and cross-section by the application of patching or leveling courses.

C. Where an asphalt mix is to be placed over a newly constructed surface treatment, sweep and dispose of all loose material from the paving area.

D. Paint all structures which will be in actual contact with the asphalt mixture, with the exception of the vertical faces of existing pavements and curbs or curb and gutter, with a uniform coating of asphalt cement to provide a closely bonded, watertight joint.

E. Apply a prime and tack coat on newly constructed bases and apply a tack coat, as specified in FDOT Specification Section 300, on existing pavement structures that are to be overlaid with an asphalt mix and between successive layers of all asphalt mixes.

3.03 PLACING MIXTURE

A. Lay all asphaltic concrete mixtures, including leveling courses, other than adjacent to curb and gutter or other true edges, by the string line method to obtain an accurate, uniform alignment of the pavement edge.

B. For each paving machine operated, use a separate crew, each crew operating as a full unit. The Contractor's Certified Paving Technician in charge of the paving operations may be responsible for more than one crew but must be physically accessible to the County at all times when placing mix.

C. Check the depth of each layer at frequent intervals, and make adjustments when the thickness exceeds the allowable tolerance. When making an adjustment, allow the paving machine to travel a minimum distance of 32-feet to stabilize before the second check is made to determine the effects of the adjustment.

D. In limited areas where the use of the spreader is impossible or impracticable, the Contractor may spread and finish the mixture by hand.

E. Straightedge and back-patch after obtaining initial compaction and while the material is still

hot.

F. Upon arrival, dump the mixture in the approved mechanical spreader, and immediately spread and strike-off the mixture to the full width required, and to such loose depth for each course that, when the Work is completed, the required weight of mixture per square yard [square meter], or the specified thickness, is secured. Carry an excess amount of mixture ahead of the screed at all times. Hand-rake behind the machine as required.

G. Construct each course in layers of the thickness as shown on FDOT Design Standards Index No. 513.

H. Before starting any rolling, check the surface; correct any irregularities; remove all drippings, fat sandy accumulations from the screed, and fat spots from any source; and replace them with satisfactory material. Do not skin patch. When correcting a depression while the mixture is hot, scarify the surface and add fresh mixture.

3.04 APPLICATION OF LEVELING COURSES

A. Before spreading any leveling course, fill all depressions in the existing surface more than 1-inch deep by spot patching with leveling course mixture, and then compact them thoroughly.

B. Place all courses of leveling by the use of two (2) motor graders; equip one with a spreader box. Use other types of leveling devices after they have been approved by the County.

C. When the total asphalt mix provided for leveling exceeds 50-lb/yds² [27-kg/m²], place the mix in two or more layers, with the average spread of any layer not to exceed 50-lb/yd² [27-kg/m²]. When using Type S-3 Asphaltic Concrete for leveling, do not allow the average spread of a layer to be less than 50-lb/yd² [27-kg/m²] or more than 75-lb/yd² [40-kg/m²]. The Contractor may vary the rate of application throughout the Project as directed by the County. When leveling in connection with base widening, the County may require placing all the leveling mix prior to the widening operation.

3.05 COMPACTING MIXTURE

A. The coverage is the number of times the roller passes over a given area of pavement. Regardless of the rolling procedure used, complete the final rolling before the surface temperature of the pavement drops below 160°F.

B. Seal Rolling: Provide two (2) coverages with a tandem steel-wheeled roller (either vibratory or static), weighing 5 to 12-tons, following as close behind the spreader as possible without pick-up, undue displacement, or blistering of the material. Use vibratory rollers in the static mode for layers of 1-inch or less in thickness.

C. Intermediate Rolling: Provide five (5) coverages with a self-propelled pneumatic-tired roller, following as close behind the seal rolling operation as the mix will permit.

D. Final Rolling: Provide one (1) coverage with a tandem steel-wheeled roller (static mode only), weighing 5 to 12-tons, after completing the seal rolling and intermediate rolling, but before the surface pavement temperature drops below 160ºF.

E. Operate the self-propelled, pneumatic-tired roller at a speed of 6 to 10-mph. For each roller,

do not exceed an area of coverage of 4,000 yd²/hour; if rolling Type S Asphaltic Concrete, do not exceed an area of coverage of 3,000 yd²/hour.

F. Use a sufficient number of self-propelled pneumatic-tired rollers to ensure that the rolling of the surface for the required number of passes does not delay any other phase of the laying operation and does not result in excessive cooling of the mixture before completing the rolling. In the event that the rolling falls behind, discontinue the laying operation until the rolling operations are sufficiently caught up.

G. Use hand tamps or other satisfactory means to compact areas which are inaccessible to a roller, such as areas adjacent to curbs, headers, gutters, manholes, etc.

H. Use self-propelled pneumatic-tired rollers to roll all patching and leveling courses. Where placing the initial leveling course over broken concrete pavement, use a pneumatic-tired roller that weighs at least 15-tons. For Type S-3 Asphaltic Concrete leveling courses, use a steel-wheeled roller to supplement the traffic rollers. On other leveling courses, use a steel-wheeled roller to supplement the traffic rollers on all passes after the first pass.

I. Do not allow the rollers to deposit gasoline, oil, or grease onto the pavement. Remove and replace any areas damaged by such deposits as directed by the County. While rolling is in progress, test the surface continuously, and correct all discrepancies to comply with the surface requirements. Remove and replace all drippings, fat or lean areas, and defective construction of any description. Remedy depressions that develop before completing the rolling by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depression remain after obtaining the final compaction, remove the full depth of the mixture, and replace it with sufficient new mixture to form a true and even surface. Correct all high spots, high joints, and honeycombing as directed by the County. Remove and replace any mixture remaining unbonded after rolling. Correct all defects prior to laying the subsequent course.

J. Use a self-propelled pneumatic-tired roller on the first structural layer placed on a milled surface. Compact with a minimum of three passes.

3.06 JOINTS

A. Place the mixture as continuously as possible. Do not pass the roller over the unprotected end of the freshly laid mixture except when discontinuing the laying operation long enough to permit the mixture to become chilled. When thus interrupting the laying operation, construct a transverse joint by cutting back on the previous run to expose the full depth of the mat.

B. For all layers of pavement except the leveling course, place each layer so that longitudinal construction joints are offset 6-inches to 12-inches laterally between successive layers.

C. When laying fresh mixture against the exposed edges of joints (trimmed or formed as provided above), place it in close contact with the exposed edge to produce an even, well-compacted joint after rolling.

3.07 SURFACE REQUIREMENTS

A. Obtain a smooth surface on all pavement courses placed, and then straightedge all intermediate and final courses with a 15-foot rolling straightedge. Furnish a 15-foot [4.572-m] manual straightedge, and make it available at the job site at all times during the paving operation for checking joints and surface irregularities.

B. Produce a finished surface of uniform texture and compaction with no pulled, torn, or loosened portions and free of segregation, sand streaks, sand spots, or ripples.

3.08 ACCEPTANCE REQUIREMENTS

A. Upon completion of the final surface or friction course, the County will test the finished surface with a 15-foot rolling straightedge. Correct all deficiencies in excess of 3/16-inch.

B. If correction is made by removing and replacing the pavement, remove the full depth of the course and extend at least 50-feet on either side of the defective area for the full width of the paving lane.

C. If correction is made by overlaying, cover the length of the defective area and taper uniformly to a featheredge thickness at a minimum distance of 50-feet on either side of the defective area. Extend the overlay the full width of the roadway. Maintain the specified cross slope. The County may adjust, as necessary, the mix used for the overlay for this purpose.

D. The maximum deficiency from the specified thickness as follows:
For pavement of a specified thickness of 2-1/2-inches or more: 1/2-inch
For pavement of a specified thickness less than 2-1/2-inches: 1/4-inch

E. Where the deficiency in thickness is: (1) in excess of 3/8-inch for pavement of less than 2-1/2-inches in specified thickness, or (2) in excess of 3/4-inch for pavement of specified thickness of 2-1/2-inches or more, correct the deficiency either by replacing the full thickness for a length extending at least 50-feet from each end of the deficient area.

F. For any case of excess deficiency of the pavement, if approved by the County for each particular location, correct the deficient thickness by adding new surface material, and compact it to the same density as the adjacent surface. The County will determine the area to be corrected and the thickness of new material added.

3.09 REPAIR AND RESTORATION

A. Replace asphalt pavement or roadway surfaces cut or damaged to equal or better condition than the original, including stabilization, base course, surface course, curb and gutter, and other appurtenances.

3.10 SIGNALIZATION, PAVEMENT STRIPING AND MARKING

A. The Contractor shall be responsible for coordinating, repairing or replacing all traffic signalization devices and traffic loops damaged during the pavement milling, removal and replacement process.

B. The Contractor shall be responsible for coordinating, inventorying, and replacing all temporary and permanent pavement striping and markings damaged during the asphalt pavement milling, removal, and replacement process.

C. Temporary pavement striping and markings shall be paint or reinforced retro-reflective removal tape. Foil back tape is not acceptable. Permanent pavement striping and markings shall be alkyd thermoplastic tape and raised reflective pavement markers.

END OF SECTION

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SECTION 02660

POTABLE WATER SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

Scope of Work: Provide a complete system for water transmission/distribution pressure piping and appurtenant items.

1.02 QUALITY ASSURANCE

A. Design Requirements
   1. Piping shall be laid with a minimum cover of 36-inches below finished grade for mains sized 12-inch and below and a minimum cover of 48-inches for mains sized 16-inch and greater. Pipe located within Local roadways (subdivisions) or within an easement, shall be laid with a minimum cover of 30-inches.
   2. Pipelines shall be constructed of the materials indicated in this specification and on the Drawings.

B. Pipe Inspection:
   1. The Contractor shall obtain a certificate of inspection from the pipe manufacturer stating that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications.
   2. The entire product of any plant may be rejected when, in the opinion of the County, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.
   3. All pipe and fittings shall be subjected to a visual inspection at the time of delivery and before being lowered into the trench. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.
   4. The County reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

C. Prevention of electrolysis is required in accordance with AWWA C105 and when crossing, or adjacent to, a power easement, gas easements, any location where induced currents may be present, in areas where aggressive soils exist, and where shown on Drawings. Electrolytic action through the contact of dissimilar metals shall be prevented by either:

   1. The separation of one material from the other by means of an insulating or dielectric coupling (polyethylene wrap), or
   2. The use of alternative materials, as directed by the County.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
   1. Mill test certificates or certified test reports on pipe

2. Details of restrained and flexible joints
3. Detailed laying schedule for pipe
4. Valves and valve boxes

1.04 JOB CONDITIONS

A. Water in Excavation
1. Dewatering shall be in accordance with. Section 02140 "Dewatering." Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the County. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working.

B. In no case shall the pipelines being installed be used as drains. The ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not by improvised equipment.

C. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the Work any such material has entered the pipelines, it must be cleaned as directed by the County so that the entire system will be left clean and unobstructed.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MATERIALS

A. Pipe, Fittings, Valves, and Ancillary Equipment shall be installed as shown on the Drawings and as specified in Division 15.

B. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding:
   1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section 02220 "Excavating, Backfilling and Compacting", a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.
   2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods approved by the County. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

3.02 INSTALLATION

A. Pipe Identification/Location
   1. All PVC water mains shall be solid blue. All lettering shall appear legibly on the pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.
   2. All ductile iron water mains shall be color coded blue with tape. The tape (minimum 2-inches) shall be permanently affixed to the top and each side of the pipe (3 locations parallel to the axis of the pipe). For pipes less than 24-inches in diameter, a single tape may be used along the top of the pipe.
   3. All HDPE water mains shall be a solid blue or black with 4 co-extruded equally spaced blue stripes of the same material as the pipe. Stripes painted on the pipe outside surface shall not be acceptable.
   4. If main is located over 30-feet from the edge of the pavement or in an easement, the Contractor shall install 4-inch diameter schedule 80 PVC utility pipe line markers over the pipe alignment at 1,000-feet intervals, at all valves, and at all locations where fittings deflect the pipe alignment in the horizontal plane. Utility pipeline markers shall include a decal and shall be colored blue for water service.
   5. All mains (PVC, HDPE, and DI) shall be installed with a continuous, insulated 10-gauge copper wire installed directly above the pipe for location purposes. Locate wire shall terminate in a test station box and be capable of extending 12-inches above the top of the box. Directionally drilled pipe shall be installed with 2 insulated 10-gauge copper wires.

B. Pipe: The color stripe and pipe text shall be located on the top of the pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.

   1. Gradient: Pipe shall be laid straight and depth of cover shall vary to provide uniform gradient or slope to pipe, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Drawings, batter boards with string line paralleling design grade, or other previously approved means, shall be

used by the Contractor to assure conformance to required grade.

2. Pipe Joint Deflection
   a. Ductile Iron Pipe: Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed 75% of the maximum limits as shown in AWWA Standard C600 for ductile iron pipe.
   b. PVC Pipe: Joint deflection or pipe bending shall not be permitted. The maximum allowable tolerance in the joint due to variances in installation is 0.75° (degrees) (3-inches per joint per 20-foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.
3. Rejects: Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.
4. Joint Compounds: No sulfur base joint compound shall be used.
5. Thrust restraints shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein. Restraining devices shall be specified in Sections 15062 "Ductile Iron Pipe and Fittings" and 15064 "Polyvinyl Chlorine (PVC) Pipe and Fittings", respectfully.

C. Installing Valves and Boxes
   1. Valves: Valves shall be carefully inspected, fully opened, and then tightly closed and the various nuts and bolts shall be tested for tightness. Any valve that does not operate correctly shall be removed and replaced.

   2. Valve Boxes: Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut. In unpaved areas, valve boxes shall be set to conform to the level of the finished surface and held in position by a concrete collar placed under the support flange as shown on the Drawings. The letter "V" shall be etched in the curb at each valve location. The valve box shall not transmit surface loads to the pipe or valve but be supported by bedding rock as shown on the Drawings. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of D.I. or PVC pipe shall be used in extending the box to its proper height. Care shall be taken to prevent earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the Work all valve boxes shall be adjusted to finish grade.

   3. Concrete Collar: Each valve installed in an unimproved area (outside of pavement, driveways or sidewalks) shall require a 24-inch by 24-inch by 6-inch concrete pad or collar as shown in the Drawings.

   4. Identification Disc: Each 16-inch or larger valve (unless otherwise shown on the Drawings) installed shall be identified by a 3-inch diameter bronze disc anchored in the concrete pad or collar in unimproved areas and/or anchored on a 4-inch by 4-inch by 18-inch long concrete post set flush with the pavement surface in improved areas. The disc shall be stamped with the following information as shown on the Drawings:
      a. Size of the valve
      b. Type of valve
      c. Service
      d. Direction and number of turns to open

D. Concrete Encasement
   1. Concrete encasement shall be constructed in accordance with details shown on the Drawings and shall be constructed of Class C concrete. Encasement shall be constructed where;
      a. Indicated on the Drawings
      b. The County orders the pipe encased

E. The points of beginning and ending of pipe encasement shall be not more than 6- inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

F. Flush Out Connections: Flush out connections shall be installed at the locations as determined by the County and be full pipe size.

G. Service Connections: Service connections shall be installed at the locations determined by the County and in the manner shown on the Drawings. No service line shall terminate under a driveway.

H. Backfilling: Backfilling shall be in accordance with Section 02320 "Trenching, Bedding and Backfilling" of these specifications.

3.02 CLEANING

A. General: At the conclusion of the Work, the Contractor shall thoroughly clean the new pipelines by flushing with water or other means to remove all dirt, stones, or other material which may have entered the line during the construction period. Flushing is permitted for pipes less than or equal to 12-inch diameter.

B. Correction of Non-Conforming Work: All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the County. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the Drawings, including but not limited to pipe not laid straight, true to the lines and grades as shown on the Drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage, or failure to pass any specified test or inspection.

3.0 FIELD QUALITY CONTROL

A. Flushing
   1. All pipelines less than or equal to 12-inches shall be flushed to remove all sand and other foreign matter. After initial slow-fill, pipe shall sit full for 24-hours to facilitate cleaning and collection of debris from interior of pipe.
   2. Flushing shall be accomplished through full pipe size connections at full pipe depth. The velocity of the flushing water shall be at least 2.5-feet per second.
   3. Flushing shall be terminated at the direction of the County. The Contractor shall dispose of the flushing water without causing a nuisance or property damage. The Contractor shall arrange with the County and pay for the source of flushing water.

4. In lieu of flushing, new water mains may be hydraulically or pneumatically cleaned with a polypropylene swabbing device in accordance with "Orange County Utilities Standards and Construction Specifications Manual."
3. The Contractor is responsible to provide temporary access and egress points.
4. Passage of the cleaning swabs through the system shall be constantly monitored, controlled, and all poly swabs entered into the system shall be individually marked and identified.
5. Cleaning of the system shall be done in conjunction with the initial filling of the system for its hydrostatic test.
6. The Contractor is responsible for collection of debris, water, and the swab. Considerations shall be made for protecting surrounding property and personnel.
7. Swabbing speed shall range between 2 and 5-feet per second.

B. Pressure and Leakage Tests of Pressure Piping
1. General: The Contractor shall perform hydrostatic pressure and leakage tests on all pressure piping. Tests shall be made between valves and shall not exceed 2,000-feet. Each side of all valves shall be pressure tested. Multiple sections of main may be tested simultaneously providing there are non-pressurized sections in between each pressure-tested section.
2. Standard: AWWA C600, Section 4, with the exceptions required herein and the exception that the Contractor shall furnish all gauges, meters, pressure pumps, and other equipment needed to test the lines.
3. Hydrostatic Pressure Test
   a. Test Pressure: Pressure test at 50% above the normal working pressure, but not less than 150-psi, unless otherwise noted on the Drawings.
   b. Test Duration: Duration is 2-hours. If during the test, the integrity of the tested line is in question, the County may require a 6-hour pressure test.
   c. Air Release: Corporation cocks at least 3/4-inch in diameter, pipe riser, and angle globe valves shall be provided at each dead-end to bleed air from the line.
4. Hydrostatic Leakage Test
   a. General: Following the pressure test, the Contractor shall perform the leakage test. The line shall be filled with water and all air removed for the test. The Contractor shall provide a pump to maintain the test pressure for the entire test period.
   b. Test Pressure: Maximum operating pressure as determined by the County but not less than 150-psi unless otherwise noted.
   c. Test duration: 2-hours.

   d. Allowable leakage:

$$L = \frac{SD(P)0.5}{148{,}000}$$

L = Allowable leakage (gallons per hour)
S = Length of pipe tested (feet)
D = Nominal diameter of pipe (inches)
P = Average test pressure maintained (psig)

   e. Visible Leakage: All leaks evident at the surface shall be repaired and leakage eliminated regardless of the measured total leakage.

f. Leakage Measurement: The amount of water required to maintain the test pressure is the leakage.

5. Wire Continuity Check: The Contractor shall perform a continuity check of the 10-gauge locating wire for the entire length of the main by performing a continuity test at each valve test station box.

3.02 DISINFECTING POTABLE WATER PIPELINES

A. General: Before being placed in service, all potable water pipelines shall be disinfected by chlorination. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required. The disinfection procedure shall be approved by the County.

B. Standard: AWWA 651, "Standard Procedures for Disinfecting Water Mains."

C. Procedure

1. Flush all dirty or discolored water from the line and introduce chlorine in approved dosages through a tap at one end while water is being withdrawn at the other end of the line.

2. The chlorine solution shall remain in the pipeline for 24-hours.

3. Following the chlorination period, all treated water shall be flushed from the line and replaced with water from the distribution system.

4. Bacteriological sampling and analysis shall be made in full accordance with AWWA Manual C651 and the appropriate FDEP permit. If necessary, the Contractor will be required to re-chlorinate.

5. Sampling and analysis shall be done by the County.

D. Approval: The line shall not be placed in service until the requirements of the State and County Public Health Department are met and the bacteriological test results are approved by the Department of Environmental Protection.

3.03 CONNECTION TO EXISTING SYSTEM

A. All connections to existing mains shall be made after complete disinfection of the proposed system and shall be made under the direction of the County. Valves separating the mains being installed from existing mains shall be operated by or under the direction of the County. The cost of the Work in making the connections shall be paid for by the Contractor.

B. In the event the proposed main is to be connected to a main which has one or more active services between the point of connection and the first existing line valve, a temporary plug or cap shall be installed on the new main until the pressure tests and disinfecting are completed. Upon satisfactory completion, the cap or plug shall be removed from both mains and the connection made with pipe which has been swabbed out with a solution of chlorine and water. The connection shall be made as swiftly as possible and any water in the ditch shall be kept below the level of the pipe. The pipeline shall then be placed in service by the County's personnel.

C. In the event any existing users will be without water while a connection is being made, the Contractor shall notify the County 72-hours prior to disconnection. The County shall notify the affected user(s) when the water will be turned off and when the service is estimated to be resumed. In some instances, these connections may have to be made at night. No user shall be without water service for more than 3-hours.

3.04 SUPPLIER'S FIELD SERVICE

A. The Contractor shall, at no additional cost to the County, arrange for a pipe supplier's field representative to be on-site to provide instruction to each crew working on the installation for a minimum of 4 push-on joints (PVC, DIP). The supplier's field representative shall certify that the installations observed were satisfactorily completed and all pipe installation crews were familiar with the proper methods and procedures for the pipeline installations.

3.05 WATER FOR USE IN FLUSHING, TESTING, AND DISINFECTION

A. The Contractor shall arrange with the County for water required for pressure testing, flushing, and disinfection required by the Contractor. The Contractor shall provide meter and backflow preventer.

END OF SECTION

SECTION 02820
FENCES AND GATES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General Fence Requirements

B. Fence Gates

1.02 REFERENCES

Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction and Roadway and Traffic Design Standards, latest implemented editions:

A. Index No. 802 - Fence Type B

B. Specification Section 550 - Fencing

1.03 SCOPE OF WORK

Furnish all materials, equipment, transportation, tools and labor, unless otherwise specified, to construct fencing and other appurtenances, and all items called for or that could reasonably be inferred from the drawings, including fabric, posts, frame, bracing, gates, motor gate operator, controls, card/access reader, and all accessories for a complete job ready to operate. If any items, for a complete job, are omitted or not shown, the Contractor shall furnish and install the same without cost to the County. The Contractor shall maintain security of the project site at the fence for the duration of the project. Any gaps in the fence made for construction shall be secured when the site is not active.

1.04 SUBMITTALS

A. Provide product data and shop drawings for all posts, rails, chain link fence fabric, tension wire, gates, motor operators, and control systems.

B. Provide drawings indicating the location of all pull posts and gate locations.

PART 2 - PRODUCTS

2.01 GENERAL

All fence and gate material shall be FDOT Fence Type B, per FDOT Roadway and Traffic Design Standards and Standard Specifications for Road and Bridge Construction. Per these standards, there are a number of options for the fence materials. Listed below are the material options selected by the County to be used for this project.

2.02 LINE POSTS

A. Zinc galvanized steel pipe (galvanized at 1.8 oz per square foot), Schedule 40, vinyl coated black, class A bonded.

B. Required size is 2-3/8 inch nominal diameter.

2.03 CORNER, END AND PULL POSTS

A. Zinc galvanized steel pipe (galvanized at 1.8 oz per square foot), Schedule 40, vinyl coated black, class A bonded.

B. Required size is 3 inch nominal diameter.

2.04 RAIL

A. Zinc galvanized steel pipe (galvanized at 1.8 oz per square foot), Schedule 20, vinyl coated black, class A bonded.

B. Required size is 1-5/8 inch nominal diameter.

2.05 CHAIN LINK FABRIC

A. No. 9 gage steel wire zinc coated (coated at 1.8 oz per square foot). The gage requirement refers to the wire plus zinc coated diameter, and does not include any other coatings.

B. Wire to be vinyl coated black, class A bonded.

C. Top to be twisted and barbed, bottom to be knuckles.

D. Required mesh size is 2 inch.

E. Required height (measured from bottom of fabric to top of fabric) is 8 feet.

2.06 TENSION WIRE

A. No. 7 gage steel wire zinc galvanized (galvanized at 1.8 oz per square foot). The gage requirement refers to the wire plus zinc coated diameter, and does not include any other coatings.

B. Wire to be vinyl coated black, class A bonded.

2.07 TIE WIRE

A. No. 9 gage steel wire zinc galvanized (galvanized at 1.8 oz per square foot). The gage requirement refers to the wire plus zinc coated diameter, and does not include any other coatings.

B. Wire to be vinyl coated black, class A bonded.

2.08 BARBED WIRE

A. Fencing shall be topped with 3 strands of barbed wire per FDOT Index 802.

2.09 GATES

A. Provide rolling gates as shown on the drawings. Also provide latches, locking device, and gate stop keeper (cane bolt and cane bolt anchor base embedded in concrete).

B. All materials to match fencing materials identified above.

C. Height of gate to match height of fence.

2.10 ELECTRIC MOTORIZED GATE

A. The facility gate system shall be furnished as a complete package by the System Supplier consisting of a vehicular motorized cantilever slide gate as shown on the drawings and as specified herein. The gate system shall include the slide gate, automatic gate operator, and all required structural and safety equipment. Facility ingress shall be by the card access system, Specification Section 16725, Card Access System. Facility egress shall be by road imbedded proximity vehicle detector. The gate controller and gate operation shall be integrated with the card access control system and the SCADA system.

B. The slide gate shall meet the following mechanical specifications:
   1. The slide gate construction shall be an ornamental, aluminum box frame design. Gate shall conform to UL 325 standards. Field verify actual gate size.
   2. Gate frame shall be 2'' x 3" x 1/8" aluminum tubing.
   3. Vertical gate pickets shall be 1" x 1" x 1/8" spaced such that there is less than a 1-1/2" gap between pickets.
   4. Gate shall have a minimum counterbalance length of 50% opening width which provides a 36% increase in lateral resistance (when compared to ASTM minimum of 40% counterbalance). If gate is ever to be automated, counterbalance section shall be filled with fabric or other specified material.
   5. The gate frame is to be supported from the track by two (2) swivel type, self-aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies.
   6. Gate shall be painted with electrostatically applied acrylic enamel. Verify color with County.
   7. Provide crawl bar to eliminate crawl space under gate frame.
   8. The bottom of each support post shall have a bracket equipped with a pair of 3" (76mm) UHMW guide wheels Wheel cover protectors shall be included with bottom guides to comply with UL325.
   9. Gap protectors shall be provided and installed, compliant with ASTM F 2200-05.
   10. The gate frame shall have a separate semi-enclosed "keyed" track, extruded from 6005A-T61 or 6105-T5 aluminum alloy, weighing not less than 2.9 lb/lf

(4.2kg/m). The track member is to be located on only one side of the top primary. Welds to be placed alternately along the top and side of the track at 9" (229mm) centers with welds being a minimum of 2" (51mm).

11. Slide Gate Operator:
    a. Gate operation shall be by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, roller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 4000 pounds. Gate panel velocity shall not be less than 2.0 feet per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The "soft stop" feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction). The "soft start" feature shall allow the pump to start at zero pressure, then progressively increase the pressure, over a period not less than two seconds, to 1,000 PSI. The gate operator shall be interfaced to the PCS for remote operation and override.
    b. Operator Code Requirements:
        1) The gate operator shall meet the following regulatory requirements:
            a) Operators shall be built to UL325 standards.
            b) Current safety standards require the use of multiple external sensors to be capable of reversing the gate in either direction upon sensing an obstruction.
            c) Current safety standards require gate operators to be designed and labeled for specific usage classes. HySecurity Model 222 EX gate operators are to be used on Class III and Class IV installations only.
    c. Functionality:
        1) The gate operator shall include the following specifications components and functionality.
            a) Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
            b) Limit switches: Fully adjustable, toggle types, with plug connection to control panel for gate open and gate closed.
            c) Two (2) vehicle proximity detection loops for safety and/or free egress operation.
            d) Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories. Enclosure shall be NEMA Type 4X stainless steel.
            e) Hydraulic hose: Shall be 1/4" synthetic, rated to 2750 psi.

f) Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.

g) Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.

h) Hydraulic fluid: High performance type with a viscosity index greater than 375.

i) A zero to 2000-PSI pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.

j) The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

k) Pump motor: Shall be a single phase, 60Hz, 208 VAC, 2 HP, 56C, TEFC, continuous duty motor, with a service factor of 1.15, or greater. All components shall have overload protection and NEMA Type 4X local disconnect/enclosure.

l) Heater with thermostat control for cold or damp climates.

m) Gate controller: HySecurity Smart Touch Controller Board with 128K memory or approved equal containing: inherent entrapment sensor; built in "warn before operate" system; built in timer to close; liquid crystal display for reporting of functions; 19 programmable output relay options; anti-tailgate mode; built-in power surge/lightening strike protection; RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems.

n) Required external sensors installed such that the gate is capable of reversing in either direction upon sensing an obstruction.

o) Radio controlled Miller safety edge or approved equal

p) UL approved EMX IRB photo safety beam with NEMA Type 4X enclosure or approved equal

q) Siren operated sensor for fire department emergency ingress. Fire department to specify sensor frequency.

r) The gate operator shall be HySecurity Model 222EX Heavy Duty Industrial Slide Gate Operator or approved equal.

2) Warranty. The gate and gate operator warranty is:

a) System Supplier one (1) year warranty on all labor and materials.

b) Manufacturer's warranty on gate operator for five (5) years.

c) Manufacturers warranty on gate drive wheels for two (2) years.

d) Manufacturers warranty on all labor for one (1) year.

e) Manufacturers warranty to commence upon COUNTY'S approval of satisfactory installation and startup.

2.11 MISCELLANEOUS HARDWARE

Zinc-coated commercial grade steel. Paint black, or as directed by County.

PART 3 - EXECUTION

3.01 POSTS

Embed all posts in 3000 psi concrete bases. All posts to extend 3 feet minimum into concrete base. All concrete base diameters to be 12 inches, top of base to crowned 1 inch above grade, bottom of base to be 6 inches below bottom of post.

3.02 FENCE FABRIC, WIRE, RAILS and ACCESSORIES

Install per FDOT requirements.

3.03 GATES

Provide cantilever gate and operator as shown on the drawings.

END OF SECTION

SECTION 02920

LAWNS AND GRASSES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Soil preparation, sodding, fertilizing, watering, and maintenance of grassed areas

1.02 RELATED SECTIONS

Section 02310 – Finish Grading

1.03 WARRANTY

All sodding shall be warranteed by the Contractor to be true to name and in a vigorous growing condition through one growing cycle including one summer and one winter season. Seed and mulch not allowed. Sod all disturbed areas.

1.04 MAINTENANCE

Maintenance for lawns shall begin immediately after sodding. Provide watering, mowing and replanting and continue as necessary until a close healthy stand of specified grasses is established.

PART 2 - PRODUCTS

2.01 LIME

Lime shall be agricultural grade dolomitic limestone, ground sufficiently fine so that at least 80 percent will pass through a No. 8 sieve, and it shall contain not less than 80 percent calcium carbonate equivalent. Moisture content at time of delivery shall not exceed 8 percent.

2.02 FERTILIZER

Fertilizer shall be a composition recommended by a local County Agricultural Agent or State Agricultural Extension Service or a preformulated 10-6-4 mixture.

2.03 WATER

Water shall be free from oil, acid, alkali, salts, and other harmful substances.

2.04 SOD

A. Sod shall be either field or nursery grown sod that is native to the locality of the Project. The Contractor shall obtain Engineer's approval of the source of the sod prior to cutting the sod.

B. Sod grown on soil high in organic matter, such as peat, will not be acceptable. The consistency of sod shall be such that it will not break, crumble or tear during handling and placing. Sod shall be reasonably free of stones, crab grass, noxious weeds, and other objectionable plants or substances injurious to plant growth.

C. Sod shall have at least 1-inch of soil adhering firmly to the roots and cut in rectangular pieces with the shortest side not less than 12-inches. At the time of cutting sod the grass shall be mowed to a height not less than 2-inches or more than 4-inches.

D. Sod cut for more than 48 hours shall not be used without the approval of the Engineer.

E. Bahia Sodding - Argentine Bahia Sod

PART 3 - EXECUTION

3.01 REGRADING OF TOPSOIL

Topsoil shall be graded reasonably smooth and level after final settlement. All humps shall be removed and depressions or eroded areas filled in with additional topsoil before proceeding with seeding or sodding.

3.02 PREPARATION FOR SODDING

A. Loosen topsoil by tilling it to a depth of at least 3 inches and smooth out all surface irregularities resulting therefrom. Leave area free of rocks or hard soil clods which will not pass through the tines of a standard garden rake.

B. At least 7 days before applying fertilizer, spread lime uniformly in sufficient quantity to produce in the soil a pH of 6.5. Work lime thoroughly into topsoil to a depth of 3-inches.

C. Apply fertilizer uniformly at a rate of 20 pounds per 1000 square feet. Work fertilizer into soil prior to seeding or sodding.

3.03 SODDING

A. Provide sod in areas indicated on the Drawings. Sodding shall also be used in ditches and drainage swales and on all embankment slopes steeper than 3 to 1 unless protection is provided against erosion of seeding.

B. Place sod with the edges in close contact and alternate courses staggered. Lightly tamp or roll to eliminate air pockets. On slopes 2 to 1 or steeper, stake sod with not less than 4 stakes per square yard and with at least one stake for each piece of sod. Stakes shall be driven with the flat side parallel to the slope. Do not place sod when the ground surface is frozen or when air temperature may exceed 90° F. Water the sod thoroughly within 8 hours after placement and as often as necessary to become

well established.

C. In ditches, the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground.

D. All exposed edges of sod shall be buried flush with the adjacent turf.

3.04 WATERING

Immediately after placing erosion control or mulch, water seeded areas thoroughly with a fine mist spray. Keep soil thoroughly moist until seeds have sprouted and achieved a growth of 1 inch. For sod, immediately begin watering and continually keep moist until the sod has firmly knit itself to the topsoil.

3.05 PROTECTION OF WORK

Protect newly seeded and sodded areas from all traffic by erecting temporary fences and signs. Protect slopes from erosion. Properly and promptly repair all damaged work when required.

3.06 APPLICATION OF FERTILIZER

Six weeks after completion of seeding or sodding apply granular fertilizer over all areas at the rate of two pounds of nitrogen nutrients per 1000 square feet of area.

3.07 CLEAN-UP

At the time of final inspection of work, but before final acceptance, remove from seeded and sodded areas all debris, rubbish, excess materials, tools, and equipment.

3.08 LAWN REPLACEMENT

Lawns not showing a close uniform stand of healthy specified grasses at the end of the guaranty period shall be replaced and maintained until acceptance. Scattered bare spots, none of which is larger than one square foot, will be allowed up to a maximum of 3% of the total area.

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 REFERENCES

A. General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this Section.

1. 03200 - Concrete Reinforcement
2. 03300 - Cast-In-Place Concrete

1.02 WORK INCLUDES

A. All formwork for concrete as described in this section, indicated on the drawings or required by other sections of these specifications. Openings for other affected work. Form accessories and stripping forms.

1.03 QUALITY ASSURANCE

A. Codes and Standards

1. Formwork shall comply with the provisions of ACI 347 "Recommended Practice for Concrete Formwork".
2. ACI "Formwork for Concrete" and Specifications for Structural Concrete for Buildings.
3. PSI - "Construction and Industrial Plywood".

B. The Contractor is solely responsible for the design, construction and performance of the formwork. The engineers examination of formwork plans and shoring operations shall in no way relieve the contractor of this responsibility.

1.04 SUBMITTALS

A. Submit to the County shop drawings prepared and designed by an engineer registered in the state of Florida, for record purposes showing layout of shoring, sections and unusual details in accordance with the General Conditions of the Contract for construction. Submit sufficient information for full description of capacity.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Forms

1. Wood
   a. For concrete below grade, use standard grade or better boards or planks; or use 3/4" minimum thickness exterior type plywood, Grade B/B, Class I, PS-1.
   b. For exposed concrete surfaces use 3/4" minimum thickness exterior type plywood, Grade B/B, Class I, sanded both sides, PS-1.
2. Steel
   a. Steel forms shall be of such thickness that they shall remain true to shape. Metal forms, which do not present a smooth surface or do not properly align shall not be used.

B. Form Oil

1. The inside of the forms shall be coated with a non-staining form oil, such as:
   a. Magic-Kote by Symons Manufacturing Company, Des Plaines, Illinois;
   b. Form-coat by Concrete Service Company, Philadelphia, Pennsylvania.
   c. Eucoslip by Euclid Chemical Company.

C. Form Ties

1. Form ties shall be snap-in form tie with a 1 inch minimum break off depth from the face of the concrete.
2. Ties shall be removed after forms are removed and holes shall then be filled with mortar that matches the adjacent surfaces.
3. Provide stainless steel form ties for all exterior surfaces exposed to view.
4. Approved Manufacturers
   a. Dayton "Sure-Grip
   b. Hechman "Snapties"
   c. Richmond "Snap-Tys"

D. Anchors

1. Zinc-coated dovetail slots (oriented vertically) shall be located at 3 feet - 0 inches on center horizontally wherever concrete surfaces adjoin masonry. Where concrete masonry (CMU) abuts columns, provide dovetail slot at centerline of adjoining CMU.
2. Approved Manufacturers
   a. Hechman Number 100 Standard, 24 gauge
   b. Hohman & Barnard, Inc., Number 305
   c. Wire Products Company, Number F-17
   d. DAS-STD by Gateway Building Products

E. Vapor Barrier: 0.006-inch thick, natural Visqueen polyethylene film, as manufactured by the Visking Company or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Forms, bracing, and supports shall be designed and constructed to withstand the pressure of freshly placed concrete. Temperatures of the concrete at time of placing, effect of vibration, speed of placement, the height of plastic concrete and similar factors shall be considered in the design. Concrete surfaces that are to be exposed shall be free of misalignment, unsightly bulges, offsets or ledges.

B. Forms shall conform to the shape, lines, grades and dimensions of the concrete as called for on the drawings. Joints in forms shall be horizontal and vertical and shall be tightly fitted to prevent leakage of mortar. All vertical surfaces shall be formed.

C. Removable sections shall be provided at sufficient intervals at the base of walls and columns to allow cleaning and inspection before concrete is placed. All open joints, holes or other blemishes shall be filled to provide a blemish free surface.

D. Forms for concrete floor slabs shall have sufficient strength and stiffness to prevent sagging or deflection while subjected to the usual construction loads. Walking on forms will not be permitted. Planks (2 in. thick) shall be distributed over the forms to prevent abuse. Wheeling of concrete or other materials directly over the forms will not be permitted. Runways above the top of the finished concrete shall be required throughout the construction period. Runways shall not rest on the reinforcing steel.

E. Embedded structural steel shapes meant to provide support for other structural elements shall be bolted to the formwork to maintain accurate positioning. Wiring or nailing will not be permitted.

F. 3/4 inch by 3/4" chamfer strips shall be placed in the corners of forms to produce beveled edges on all permanently exposed surfaces. Corners, which abut masonry walls, shall not be chamfered.

G. Forms shall be checked just prior to placing concrete and tightened as required to produce flush surfaces.

H. Provisions shall be made for chases, offsets, openings, depressions, curbs and bulkheads.

I. Camber formwork to compensate for anticipated deflections in the formwork due to weight of forms and wet concrete, and/or any additional camber as shown on the drawings.

J. Floors have not been designed to carry the construction loads of the floor above. Contractor must design and furnish necessary shoring and reshoring to support the loads.

K. The shores and supports for the formwork shall have ample strength to support all applied loads without settlement. Provide positive means of adjustment (wedges or jacks) for shores to take up any settlement during placement.

L. Sills, if any, shall rest on solid ground, free from frost. Studs, walls, and bracing shall be dimension stock of sizes as required by form design. Dimensions of centering, bracing, etc. shall be in accordance with "ACI Recommended Practices for Concrete Formwork" (ACI 347).

M. Sleeves, Reglets, Inserts and Conduits: After forms are erected and before reinforcement is placed, all sleeves, reglets and inserts for mechanical trades must be set in place by the trade involved. Other sleeves, anchors, inserts, anchor bolts, specialties and similar items embedded in the concrete shall be furnished, accurately located as shown and set by the Contractor. In general, electric conduits shall be placed within the middle one-third of the thickness of the concrete in which it is embedded.

N. Before placing reinforcement or concrete the surface of the form shall be coated with approved non-staining form oil to prevent bond with the concrete surface.

O. Reinforcements shall be adjusted to fit the sleeves, inserts, and openings, using additional bars where required around openings.

3.02 BULKHEADS

A. Place bulkheads where end of days' work requires a joint in a wall, beam or slab. Reinforcing steel shall extend through the bulkhead. All joints shall be keyed for 2 of the member thickness unless directed otherwise by the County. Location of bulkhead must be approved by the County.

3.03 REMOVAL OF FORMS

A. Forms shall not be removed from concrete surfaces until the following minimum requirements are met.

1. Formwork for concrete slabs and beams shall remain in place for a minimum of 48 hours, and until the concrete has achieved 75% of its design strength. Strength shall be determined by tests on cylinders site-cured under the same conditions as the work in question.
2. Column and wall formwork can be removed in 48 hours provided curing compound is applied immediately. If Contractor elects not to provide curing compound, forms must remain in place 7 days minimum.

3.04 RESHORING

A. When reshoring is permitted or required, the operations shall be planned in advance and shall be subject to approval. While reshoring is under way, no live load shall be permitted on the new construction.

B. In no case during reshoring shall concrete in beam, slab, column or any other

structural member be subjected to combined dead and construction loads in excess of the loads permitted by the County for the developed concrete strength at the time of reshoring. Reshores shall be placed as soon as practicable after stripping operations are complete but in no case later than the end of the working day on which stripping occurs. Reshores shall be tightened to carry their required loads without over stressing the construction. Reshores shall remain in place until tests representative of the concrete being supported have reached the specified strength or the strength specified in the contract documents for removal of reshores.

C. Floors supporting shores under newly placed concrete shall have their original supporting shores left in place or shall be reshored. The reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases shall have a capacity equal to at least one half of the capacity of the shoring system above. The reshores shall be located directly under a shore position above unless other locations are acceptable.

3.05 REUSE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound to concrete contact form surfaces as specified for new formwork.

B. When forms are intended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, unless as acceptable to County.

3.06 VAPOR BARRIER

A. Before laying of sheet, subgrade must be smoothed eliminating any protrusions that may cause damage or rupturing of film.

B. Use widest practical widths; lapping where required shall be a Z-lock not less than 6 inches wide with top lap placed in the direction of the spreading of the concrete and underneath the reinforcing mesh prior to pouring.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 REFERENCE

A. General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this Section.
   1. 03100 - Concrete Formwork
   2. 03300 - Cast-In-Place Concrete
   3. 03410 - Precast Concrete Structures

1.02 WORK INCLUDES

A. Provide concrete, concrete masonry unit and precast concrete reinforcement as shown on the drawings, required by these specifications or necessary for proper completion of the work.

1.03 SUBMITTALS

A. Shop drawings showing all bar sizes, supports, fabrication dimensions and location for placing of the reinforcing in accordance with the General Conditions of the Contractor for construction shall be submitted for approval. Approval shall be obtained prior to fabrication.

B. Comply with the ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, diagrams of bent bars, and arrangements of concrete reinforcement.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the most recent edition of the following codes, specifications and standards, except as otherwise shown or specified.
   1. ACI 301 - Guidelines for Structural Concrete for Building.
   2. ACI 315 - Details and Detailing of Concrete Reinforcement.
   3. ANSI/ASTM A83 - Cold Drawn Steel Wire for Concrete Reinforcement.
   4. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
   5. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
   6. ANSI/AWS D1.4 - Structural Welding Code Reinforcing Steel.
   7. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   8. ASTM A616 - Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
   9. ASTM A617 - Axle-Steel Deformed and Plain Bars for Concrete

Reinforcement.

10. CRSI - Manual of Practice.
11. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
12. CRSI 65 - Recommended Practice for Placing Bar Supports, Guidelines and Nomenclature.
13. No foreign steel shall be used.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Reinforcing Bars shall be rolled from new billet steel, Grade 60 and deformed in accordance with ASTM A615, for bars numbers 3 to number 18 and shall be epoxy coated conforming to ASTM A776 81 for piles and grade beams only.

B. Welded wire fabric shall be ASTM A185, welded steel wire fabric. The yield strength of the steel wire shall not be less than 60,000 pounds per square inch and shall be epoxy coated conforming to ASTM A776 81.

C. Bar Supports and Spacers

1. For unexposed concrete, bar supports and spacers shall be manufactured of standard brights basic wire upturned legs.
2. For concrete which will be exposed to view from the underside upon completion of the structures, use plastic capped bar supports and spacers.
3. For slabs on grade, use bolsters with runners where base will not support chair legs.
4. Do not use wood, brick or other non-specified material.

D. Tie wire: Federal specifications QQ-W-461 Annealed Steel, 16 ga. minimum for use on epoxy coated steel reinforcement.

E. Welded electrodes: AWS A5.1, Low Hydrogen, E70 Series.

F. Welded Inserts: Provide wedge inserts for the support of brick ledger angles. Wedge inserts shall be placed at 4'-0" o.c. unless drawings indicate a more restrictive spacing. Provide the F-7 wedge insert and 3/4" diameter askew bolt, nut and washers as manufactured by Dayton Superior, 11176 Boggy Creek Rd, Orlando, FL , or equal.

Wedge inserts and 3/4" diameter bolts to be deemed equal shall submit test information documenting an ultimate capacity of at least 8,500 pounds when the shelf angle is loaded 2-1/4" from the face of concrete, with the bottom of the insert 1-1/2" clear from the beam bottom, for concrete strength of 4,000 psi.

PART 3 EXECUTION

3.01 GENERAL

A. Cleaning and storage reinforcement: Steel reinforcement at the time concrete is

placed shall be free from heavy rust, scale or other coating that will destroy or reduce the bond.

B. All reinforcing steel shall be stored in neat piles at the site clear of the ground in such a manner that all bars can be readily identified when required.

C. Excessive form oil on the reinforcing shall be removed by washing the reinforcing with kerosene. Exercise due care that no smoking or welding is permitted in the area of cleaning. Provide fire extinguisher at cleaning site.

D. Supports for reinforcing steel: All reinforcing steel shall be rigidly supported, accurately located and held in position by the use of proper reinforcing steel supports, spacers and accessories before the concrete placement begins.

E. The legs of all reinforcing supports shall be bent to form a foot so that the side and not the end of leg rods bears on the form.

F. Metal reinforcement shall be protected by the thickness of the concrete indicated on the drawings. Where not otherwise shown, the concrete cover shall be not less than the following:
   1. 3 inches for footings and other principal structural members poured directly against the ground.
   2. 2 inches for bars larger than number 5, and 1-1/2 inches for number 5 bars and smaller where concrete will be exposed to the ground or weather after removal of forms.
   3. 1-1/2 inches in all beams, girders and columns.
   4. 3/4 inches for all slabs and walls not exposed to the ground or weather.
   5. In any event, there shall be not less than 3/4" of concrete protection over all reinforcing bars.

G. Do not use bar supports or reinforcing as support for concrete runways or construction loads.

H. Placing tolerances: Clear distance to formed surfaces: +/- 1/4 inch. Minimum spacing between bars: -1/4 inch:
   1. Top Bars in Slabs or Beams:
      a. Members 8" or less in depth: +/- 1/4 inch
      b. Members 8" to 24" in depth: +/- 1/4 inch
      Members 24" or greater in depth: +/- 1/2 inch
   2. Crosswire of Slabs or Beams: Spaced evenly within 2 inches.
   3. Lengthwise of Member: +/- 2 inches

I. Bending details: Typical bending and placing diagrams are shown on the drawings. For parts not shown, bending details and lengths shall conform to the requirements of the ACI Building Code 318 and "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315.

J. Bends for stirrups and ties shall be made around a pin having the diameter no less than 1-1/2 inches for number 3, and 2 inches for number 4.

K. Bends for other bars shall be made around a pin having a diameter not less than six bar diameters for number 3 to number 6, 8 bar diameters for number 9, number 10 and number 11, 10 bar diameters for number 14 and number 18.

L. All bars shall be bent cold. Heating of bars will not be allowed.

3.02 SPECIAL REINFORCING REQUIREMENTS

A. Where walls or other items are shown as built integrally with other section, but are placed as separate pours, key and dowels must be provided. Dowels shall be the same size and at the same spacing as reinforcing.

B. Main reinforcing bars shall not be spliced unless so noted on the drawings or approved by the Architect/Engineer.

C. Provide 6 X 6 - W1.4 X W1.4 electrically welded wire fabric, ASTM A-185 reinforcing in all concrete slabs on ground unless shown otherwise.

D. Provide corner bars of same size and spacing as main reinforcement at all intersections and corners.

E. Where openings occur in walls, or slabs, provide two number 5 bars at all sides and extending at least two feet beyond the corners and two number 5 bars at least three feet long diagonally across each re-entrant corner.

F. Unless permitted by an Inspector employed by the County reinforcement shall not be bent after being embedded in hardened concrete.

3.03 INSPECTION OF REINFORCEMENT

A. Reinforcing placement must be checked by an Inspector employed by the County before any concrete is placed. Any corrections shall be made before concrete is placed.

B. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within the placement area and retains the right to require necessary revisions be made before concrete is placed.

C. The Contractor shall notify the Inspector at least 24 hours in advance of concrete placement for a particular portion of the building.

D. Galvanized wire ties of double loop and tightly fastened to secure the proper spacing of rods and ties are required.

3.04 LAP SPLICING

A. Welded wire fabric shall be overlapped wherever successive mats or rolls are continuous such that the overlap measured between outermost cross wires is not less than one wire spacing plus 2 inches.

B. Longitudinal (continuous) footing reinforcing: Class B.

C. Beam Reinforcing: Class B.

D. Column Reinforcing: Class B Offset lap splices.

E. Column/footing dowels: Class B

F. Masonry vertical reinforcing: Class B.

G. Splices not included above: Class B.

END OF SECTION

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SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section specifies cast-in-place concrete including all materials, mixing and transport, and performing all labor for the proportioning, mixing, transporting, placing, consolidating, finishing, and curing of concrete.

B. Related Work Described Elsewhere:
   1. Section 03100 "Concrete Formwork"
   2. Section 03200 "Concrete Reinforcement"

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the requirements of the following standards:
   1. Standard Building Code
   2. Local Codes and Regulations
   3. ACI 318-83, Building Code Requirements for Reinforced Concrete

B. Plant Qualification: Plant equipment and facilities shall meet all requirements of the checklist for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C 94.

C. Evaluation and Acceptance of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 4.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Materials and Shop Drawings: The following information shall be submitted for review. No concrete shall be furnished until the County has reviewed submittal and no exceptions taken or other favorable response has been returned.
   1. Plant Qualification: Satisfactory evidence shall be submitted indicating that the plant and operators have sufficient experience in providing the applicable design mix.

2. Materials: Satisfactory evidence shall be submitted indicating those materials to be used (including cement, aggregates and admixtures) meet the specified requirements.
3. Design Mix: The design mix to be used shall be prepared by qualified persons and submitted for review. Submit affidavit as to design mix performance over the preceding 6-months. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications. Acceptance of this submission will be required only as minimum requirements of the Specifications have been met. Such acceptance will in no way alter the responsibility of the Contractor to furnish concrete meeting the requirements of the Specifications relative to strength and slump.
4. Ready Mix Concrete: Provide delivery tickets or weigh master's certificate per ASTM C 94, including weights of cement and each size aggregate, amount of water in the aggregate, and amount of water added at the plant. The amount of water added on the job shall be written on the ticket.

PART 2 PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MATERIALS

A. Cement
   1. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C 150 Type I, Type II or Type III. All sanitary sewer manholes, wetwells, pumping stations, tanks and structures exposed to wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the review and acceptance of the County. Type I cement may be used for buildings and tremie concrete.
   2. Only 1 brand of cement shall be used in any individual structure unless acceptable by the County. Cement that has become damaged, partially set, lumpy or caked shall not be used and the entire contents of the sack or container that contains such cement will be rejected. No salvaged or reclaimed cement shall be used.
   3. Fly ash shall not be used in either Class A or Class B concrete.

B. Aggregates:
   1. ASTM C 33. Coarse aggregates shall be size No. 57. Block cell fill shall be size No. 89.
   2. In addition to requirements of ASTM C 33 for structures exposed to wastewater, the following shall apply:
      a. Soft particles: 2% (2.0 percent)
      b. Chert as a soft impurity (defined in Table 3 of ASTM C 33): 1% (1.0 percent)
      c. Total of soft particles and chert as a soft impurity: 2% (2.0 percent)
      d. Flat and elongated particles (long dimension > 5 times short dimension): 15%.

C. Water: Clean and free from injurious amounts of deleterious materials.

D. Air Entraining Admixture: ASTM C 260.

E. Water Reducing and Retarding Admixture: ASTM C 494, Type D. Admixture shall not contain calcium chloride.

F. Epoxy Bonding Agent: Sikastix 370, Sikadur Hi Mod, Concresive 1001-LPL or acceptable equal.

G. Waterproofing Material: Concrete admixture shall be manufactured and supplied by an approved manufacturer as shown in the Appendix D "List of Approved Products."

2.03 MIXES

A. General Requirements
   1. Mix Design: Proportioning shall be on the basis of field experience and/or trial mixtures as specified in ACI 318, Section 4.3. Data on consecutive compression tests and standard deviation shall be submitted. Proportioning for small structures may be by the water/cement ratio under special review and acceptance by the County. Concrete mix design shall comply with the Standard Building Code requirements.
   2. Air Content: 5% plus or minus (±) 1% (Class A and B).
   3. Slump: 4-inches plus or minus (±) 1-inch. 8-inches plus or minus (±) 1-inch for tremie concrete.
   4. Water/cement ratio = 0.45 maximum (all concrete exposed to hydrostatic loading), 0.50 maximum (all other concrete).
   5. Minimum Compressive Strength at 28-days
      a. Class A, 4,000-psi: Water and wastewater structures inclusive of tanks, ditches, pumping stations, tremie concrete and other structures in contact with process water.
      b. Class B, 3,000-psi: Building structures, curb and gutters, slabs, walks, encasements, thrust blocks, and pipe supports, etc. not in contact with process water.
      c. Class C, 2,500-psi: Mix wherever specified in the standard drawings such as A103, A112, A303, A406 and A407-2.

B. Production of Concrete
   1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise indicated.
   2. Air Entraining Admixture: Air entraining admixture shall be charged into the mixture as a solution and shall be measured by means of an acceptable mechanical dispensing device. The liquid shall be considered a part of the mixing water.

3. Waterproofing admixture: New concrete structures shall contain a crystalline waterproofing concrete admixture. Crystalline waterproofing concrete admixture shall be added to the concrete during the batching operation. The admixture concentration shall be added based upon manufacturer design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admixture was added to the concrete for all precast structures. Colorant shall be added and provided at the admixture manufacturing facility, not at the concrete batch plant. It is recommended that the admixture be added first to the rock and sand and blended thoroughly before adding cement and water or per the manufacturer's recommendations. Concrete structures without crystalline waterproofing admixture or admixture without colorant for field verification shall be rejected. Contractor shall provide certification the admixture was installed in accordance with the manufacturer's recommendations.
4. Water Reducing and Retarding Admixture: Water reducing and retarding admixture shall be added and measured as recommended by the manufacturer. The addition of the admixture shall be completed within 1-minute after addition of water to the cement has been completed, or prior to the beginning of the last 3/4 of the required mixing, whichever occurs first. Admixtures shall be stored, handled and batched in accordance with the recommendations of ACI 68.

C. Delivery Tickets: In addition to the information required by ASTM C 94, delivery tickets shall indicate the cement content and the water/cement ratio.

D. Temperatures: The temperature of the concrete upon delivery from the truck shall not exceed 90° F.

E. Modifications to the Mix: No modifications to the mix shall be made in the plant or on the job which will decrease the cement content or increase the water/cement ratio beyond that specified.

PART 3 EXECUTION

3.01 PREPARATION

A. Preparations before Placing: No concrete shall be placed until the review and acceptance of the County has been received. Acceptance will not be granted until forms are clean and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. The County shall be notified a minimum of 24-hours before concrete is placed.

B. Conveying:
1. General: Concrete shall be handled from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90-minutes after mixing has begun for that particular batch.

2. Buckets and Hoppers: Buckets and hoppers shall have discharge gates with a clear opening equal to no less than 1/3 of the maximum interior horizontal area, or 5 times the maximum aggregate size being used. Side slopes shall be no less than 60° (degrees). Controls on gates shall permit opening and closing during the discharge cycle.
3. Runways: Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.
4. Elephant Trunks: Hoppers and elephant trunks shall be used to prevent the free fall of concrete of more than 6-feet.
5. Chutes: Chutes shall be metal or metal lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-feet long and chutes not meeting the slope requirements may be used only if they discharge into a hopper before distribution.
6. Pumping Equipment: Pumping equipment and procedures shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods," ACI 304.2R-71. The specified slump shall be measured at the point of discharge. The loss of slump in pumping shall not exceed 1-1/2-inches.
7. Conveying equipment Construction: Aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer shall not be permitted.
8. Cleaning: Conveying equipment shall be cleaned at the end of each concrete operation.

3.02 APPLICATION

A. Placing:
1. General: Concrete shall be deposited continuously, or in layers of such thickness (not exceeding 2-feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness.
2. Supported Elements: At least 2-hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.
3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures that will cause segregation.
4. Concrete Underwater: All concrete, except that indicated on the Drawings as tremie concrete, shall be placed in the dry.

B. Seals and Tremie Concrete
1. General
   a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.
   b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.
2. Method of Placing: Concrete deposited underwater shall be carefully placed in the

space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than 1-cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited. All seal concrete shall be deposited in 1 continuous pour. No concrete shall be placed in running water. All formwork designed to retain concrete underwater shall be watertight, and the design of the formwork and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.

3. Use of Tremie: The tremie shall consist of a tube having a minimum inside diameter of 10-inches, and shall be constructed in sections having tight joints. No aluminum parts that have contact with the concrete will be permitted. The discharge end shall be entirely seated at all times, and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper, the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the Work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous, and in no case shall be interrupted until the Work is completed. Special care shall be exercised to maintain still water at the point of deposit.
4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.
5. Time of Beginning Pumping: Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72-hours after placement of the concrete.

C. Consolidating Concrete:
   1. General: Concrete shall be consolidated by means of internal vibrators operated by competent workmen.
   2. Vibrators: Vibrators shall have a minimum head diameter of at least 2-inches, a minimum centrifugal force of 700-pounds and a minimum frequency of 8,000 vibrations per second.
   3. Vibrators for Confined Areas: In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1-1/2-inches, a minimum centrifugal force of 300-pounds and a minimum frequency of 9,000 vibrations per second.
   4. Spare Vibrator: One (1) spare vibrator for each 3 in use shall be kept on the site during all concrete placing operations.
   5. Use of Vibrators: Vibrators shall be inserted and withdrawn at points approximately 18-inches apart. The duration of each insertion shall be from 5 to 15-seconds. Concrete shall not be transported in the forms by means of vibrators.

D. Protection: Rainwater shall not be allowed to increase the amount of mixing water, or to damage the surface finish. Concrete shall be protected from construction over-loads. Design loads shall not be applied until the specified strength has been attained.

3.03 CONCRETE FINISHING AND CURING

A. All slabs exposed to view shall receive a steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

B. All other slabs and footings shall receive a smooth steel trowel finish.

C. All walls of structures or parts of buildings exposed to view shall receive the following:
   1. Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes.
   2. Any surface not receiving a special applied finish, shall receive a slurry finish consisting of 1 part cement and 1-1/2 parts sand by damp loose volume. Dampen surfaces and then apply the slurry with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
   3. Surfaces that will receive a special applied finish shall be of even color, have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff bristle fiber brush shall produce no dusting or dislodging of cement or sand.

D. All concrete shall be wet cured a minimum of 7-days; or if not to receive special finishes, coatings or concrete toppings, an acceptable curing compound may be utilized.

E. All surface defects shall be repaired by removing defective concrete down to sound concrete and repairing with patching mortar. Finished repair shall match adjacent concrete and be cured as specified.

3.04 TESTING

A. A testing laboratory, acceptable by the County, shall perform required testing. The Contractor shall pay for all tests indicating a failure to comply with the Specifications. The Contractor shall keep the laboratory informed of his schedule.

B. Standard laboratory compressive test cylinders shall be obtained by the laboratory when concrete is discharged at the point of placing (i.e., discharge end of pumping equipment), and cylinders shall be made and cured in accordance with the requirements of ASTM Designation C 31. A set of 4 cylinders shall be obtained for each 50-cubic yards, or fraction thereof, placed each day for each type of concrete. The cylinders shall be cured under laboratory conditions and shall be tested at 7 and 28-days of age in accordance with the requirements of ASTM Designation C 39.

C. The testing laboratory shall make slump tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests shall be made for each 25-cubic yards or "pour" of concrete placed. Slump tests may be made on any batch, and failure to meet specified slump requirements shall be sufficient cause for rejection of that batch.

END OF SECTION

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SECTION 03345

CONCRETE FINISHING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Provide finishes on cast-in-place concrete as called for on the Drawings, specified herein, and needed for a complete and proper installation.

B. Related work:

1. Section 03300: Cast-in-place Concrete.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Except as may be modified herein or otherwise directed by the Architect, comply with ACI 301, "Specifications for Structural Concrete for Buildings."

1.03 SUBMITTALS

A. Product data: Within 35 calendar days after the Contractor has received the County's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Manufacturer's recommended installation procedures which, when approved by the County, will become the basis for accepting or rejecting actual installation procedures used on the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
1. Carefully study the Drawings and these Specifications, and determine the location, extent, and type of required concrete finishes.
2. As required for the Work, provide the following materials, or equals approved in advance by the County.

B. Concrete materials: Comply with pertinent provisions of Section 03300, except as may be

modified herein.

C. Liquid bonding agent: “Weld-Crete,” manufactured by the Larsen Products Corporation.

D. Curing and protection paper:
   1. Approved products:
      a. "Sisalkraft, Orange Label";
      b. Equal products complying with ASTM C171.
   2. Where concrete will be exposed and will be subjected to abrasion, such as floor slabs, use non-staining paper such as "Sisalkraft, Seekure 896," or equal paper faced with polyethylene film.

E. Liquid curing agents:
   1. Where application of specified finish materials will be inhibited by use of curing agents, cure the surface by water only; do not use chemical cure.
   2. For curing other areas, use "Hunt TLF" manufactured by Hunt Process Company, Inc.

F. Floor sealer: Acceptable products:
   1. "Superkote Special Clear Sealer" manufactured by Ven-Chem Company, Inc., P.O. Box 3186, Santa Barbara, California 93105 (213) 342-1195.
   2. "Supershield" manufactured by James Darcey Company, Inc., 19712 Merridy Street, Chatsworth, California 91311 (213) 349-3705.

G. Slip-resistant abrasive aggregate:
   1. Provide aluminum oxide, 14/36 grading.
   2. Acceptable manufacturers:
      a. Carborundum Company;
      b. Norton Company;
      c. L. M. Scofield Company.

2.02 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the County.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FINISHING OF FORMED SURFACES

A. General:
   1. After removal of forms, give the concrete surfaces one or more of the finishes

specified below where so indicated on the Drawings.

2. Revise the finishes as needed to secure the approval of the County.

B. As-cast finish:
   1. Rough form finish:
      a. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.
      b. Remove fins exceeding 1/4" in height.
   2. Smooth form finish:
      a. Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces, with number of seams kept to a practical minimum and in a uniform and orderly pattern.
      b. Patch tie holes and defects.
      c. Remove fins completely.

C. Rubbed finishes:
   1. Provide these finishes only where specifically called for, and then only on a "smooth form finish" base as described above.
   2. Smooth rubbed finish:
      a. Produce on newly hardened concrete no later than the day following form removal.
      b. Wet the surfaces, and rub with carborundum brick or other abrasive until uniform color and texture are produced.
      c. Do not use a cement grout other than the cement paste drawn from the concrete itself by the rubbing process.
   3. Grout cleaned finish:
      a. Do not start cleaning operations until all contiguous surfaces to be cleaned are completed and accessible.
      b. Do not permit cleaning as the work progresses.
      c. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.
      d. Substitute white portland cement for part of the gray portland cement as required to produce a color matching the color of surrounding concrete, as determined by a trial patch.
      e. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout, and apply the grout uniformly with brushes or spray gun.
      f. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.
      g. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack, or other means.
      h. After the surface whites from drying (about 30 minutes at normal temperatures), rub vigorously with clean burlap.
      i. Keep the surface damp for at least 36 hours after final rubbing.

D. Unspecified finish: If the finish of formed surfaces is not specifically called out elsewhere in the Contract Documents, provide the following finishes as applicable.
   1. Rough form finish:
      a. For all concrete surfaces not exposed to public view.
   2. Smooth form finish:

a. For all concrete surfaces exposed to public view.

3.03 FINISHING SLABS

A. Definition of finishing tolerances:
   1. "Class A": True plane within 1/8" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.
   2. "Class B": True plane within 1/4" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.
   3. "Class C": True plane within 1/4" in two feet as determined by a two foot straightedge placed anywhere on the slab in any direction.

B. Scratched finish: After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance, roughen the surface with stiff brushes or rakes before the final set.

C. Floated finish:
   1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
   2. During or after the first floating, check the planeness of the surface with a ten-foot straightedge applied at not less than two different angles.
   3. Cut down high spots and fill low spots, and produce a surface with a Class B tolerance throughout.
   4. Refloat the slab immediately to a uniform sandy texture.

D. Troweled finish:
   1. Provide a floated finish as described above, followed by a power troweling and then a hand troweling.
      a. Produce an initial surface which is relatively free from defects, but which still may show some trowel marks.
      b. Provide hand troweling when a ringing sound is produced as the trowel is moved over the surface.
      c. Thoroughly consolidate the surface by hand troweling.
   2. Provide a finished surface essentially free from trowel marks, uniform in texture and appearance, and in a plane of Class A tolerance.
      a. For concrete on metal deck, Class B plane tolerance is acceptable.
      b. On surfaces intended to support floor coverings, use grinding or other means as necessary and remove all defects of such magnitude as would show through the floor covering.

E. Broom finish:
   1. Provide a floated finish as described above.
   2. While the surface is still plastic, provide a textured finish by drawing a fiber bristle broom uniformly over the surface.
   3. Unless otherwise directed by the Architect, provide the texturing in one direction only. Provide "light," "medium," or "coarse" texturing as directed by the County or otherwise called for on the Drawings,
   4. Provide “light,” “medium,” or “coarse” texturing as directed by the Architect or otherwise called for on the Drawings.

F. Unspecified finish: If the finish of slab surfaces is not specifically called for elsewhere in the Contract Documents, provide the following finishes as applicable:
    1. Scratched finish:
        a. For surfaces scheduled to receive bond-applied cementitious applications.
    2. Floated finish:
        a. For surfaces intended to receive roofing.
    3. Troweled finish:
        a. For floors intended as walking surfaces;
        b. Floors scheduled to receive floor coverings or waterproof membrane;
    4. Broom finish:
        a. Exterior pedestrian ramps.
    5. Non-slip finish:
        a. Platforms, steps, and landings;
        b. Exterior pedestrian ramps.

3.04 CURING AND PROTECTION

A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures, and mechanical injury.

B. Preservation of moisture:
    1. Unless otherwise directed by the Architect, apply one of the following procedures to concrete not in contact with forms, immediately after completion of placement and finishing.
        a. Ponding or continuous sprinkling;
        b. Application of absorptive mats or fabric kept continuously wet;
        c. Application of sand kept continuously wet;
        d. Continuous application of steam (not exceeding 150 degrees F) or mist spray;
        e. Application of waterproof sheet materials specified in Part 2 of this Section;
        f. Application of other moisture-retaining covering as approved by the Architect;
        g. Application of the curing agent specified in Part 2 of this Section or elsewhere in the Contract Documents.
    2. Where forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safely.
    3. Cure concrete by preserving moisture as specified above for at least seven days.

C. Temperature, wind, and humidity:
    1. Cold weather:
        a. When the mean daily temperature outdoors is less than 40 degrees F, maintain the temperature of the concrete between 50 degrees F and 70 degrees F for the required curing Period.
        b. When necessary, provide proper and adequate heating system capable of maintaining the required heat without injury due to concentration of heat.
        c. Do not use combustion heaters during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases, which contain carbon dioxide.
    2. Hot weather: When necessary, provide wind breaks, fog spraying, shading,

sprinkling, ponding, or wet covering with a light colored material, applying as quickly as concrete hardening and finishing operations will allow.

3. Rate of temperature change: Keep the temperature of the air immediately adjacent to the concrete during and immediately following the curing period as uniform as possible and not exceeding a change of 5 degrees F in any one hour period, or 50 degrees F in any 24 hour period.

D. Protection from mechanical injury:

1. During the curing period, protect the concrete from damaging mechanical disturbances such as heavy shock, load stresses, and excessive vibration.
2. Protect finished concrete surfaces from damage from construction equipment, materials, and methods, by application of curing procedures, and by rain and running water.
3. Do not load self-supporting structures in such a way as to overstress the concrete.

END OF SECTION

SECTION 03410

PRECAST CONCRETE STRUCTURES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section specifies the materials, labor and equipment required to construct manholes, wetwells, valve vaults, mitered end sections, meter boxes and all other precast concrete structures, as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards.
   1. Standard Building Code
   2. Local Codes and Regulations
   3. ACI Building Code Requirements for Reinforced Concrete
   4. American Society for Testing and Materials (ASTM)
   5. American Concrete Institute (ACI)

   The forms, dimensions, concrete, and construction methods shall be acceptable to the County in advance of construction.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. The Contractor shall submit Shop Drawings to the County, showing all details of construction, reinforcing and joints.

C. Submit manufacturer's data on certifications and testing for concrete waterproofing additive, joint mastic, gaskets and grout material to be used.

1.04 INSPECTION

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and acceptance by the County. Such inspection may be made at the place of manufacture or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time due to failure to meet any of the specification requirements; even though sample sections may have been acceptable as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All damaged sections will be rejected. If

damaged sections have already been installed; they shall be acceptably repaired if authorized by the County, or removed and replaced at the Contractor's expense.

B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified and the acceptable manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch strength", blisters, cracks, roughness, and soundness. The surface shall be dense and close textured.

C. Imperfections may be repaired subject to the review and acceptance of the County after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final review and acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000-psi at the end of 7-days and 5,000-psi at the end of 28-days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the review and acceptance of the County.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 PRECAST CONCRETE SECTIONS

A. Precast concrete waste holding tank sections (wetwell sections) shall conform to specifications for precast reinforced concrete manhole sections, ASTM Designation C478, except as otherwise specified below or as shown on the Drawings. Details of precast sections shown on the Drawings, including thickness and reinforcing, shall supersede ASTM C-478 when such details are more stringent than ASTM C-478. The method of construction shall conform to the detailed Drawings appended to these specifications and the following additional requirements:

1. The minimum wall thickness for the various size barrel sections shall be 5-inches, or as indicated in the Drawings.
2. Barrel sections shall have tongue and groove joints. Joints shall be sealed with cold adhesive preformed plastic gaskets set in double rows on the tongue and in the groove prior to setting the next section. Gaskets shall be K.T. Snyder "Ram-Nek", Conseal "CS-102" or acceptable equal. All extension joints shall be sealed with Portland Type II cement after setting of gasket and placement of manhole section into a watertight joint.
3. Type II cement shall be used except as otherwise accepted.
4. New concrete structures shall contain a crystalline waterproofing concrete admix for all new concrete structures including but not limited to manholes, ARV vaults, wetwells, and wetwell top slabs. Crystalline waterproofing concrete admix shall be added to the concrete during the batching operation. Admixture concentration shall be added based upon manufacturer's design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admixture was added to the

concrete. Colorant shall be added and provided at the admixture manufacturing facility, not at the concrete batch plant. It is recommended that the admixture be added first to the rock and sand and blended thoroughly before adding cement and water or per the manufacturer's recommendations. Concrete structures without crystalline waterproofing admixture or admixture without colorant for field verification shall be rejected. Contractor shall provide certification from the pre-caster that the admixture was added in accordance with the manufacturer's recommendations. Concrete admixture shall be manufactured and supplied by an approved manufacturer as shown in Appendix D "List of Approved Products."

5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section. Each section must be inspected and stamped by an accredited testing laboratory.
6. Sections shall be cured by an acceptable method for at least 28 days.
7. Manhole top sections shall be eccentric except that precast concrete slabs shall be used where cover over the top of the pipe is less than 4-feet for all manholes. Lift rings or non-penetrating lift holes shall be provided for handling precast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.
8. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading.
9. The tops of bases shall be suitably shaped to mate with the adjoining precast section.
10. Precast leveling rings for setting cast iron frames over manholes shall be 2-inch thick and have 1 (one) Number 2 continuous reinforcing steel bar.
11. Concrete surfaces shall have form oil, curing compounds, dust, dirt, and other interfering materials removed by brush sand blasting and shall be fully cured prior to delivery.
12. Interior surfaces of waste holding tanks and valve vaults shall be lined in accordance with Appendix D "List of Approved Products."
13. Manholes to be installed around existing gravity sewers shall consist of a cast-in-place concrete base slab and precast concrete barrel and top sections; lined per Section 03410 – 2.01.11. The base slab shall be as shown on the Drawings and include a joint which is compatible with the bottom barrel section and acceptable to the County. The bottom barrel section shall include an inverted "U-shaped" slot to allow installation of the section over existing pipes. Flow channels shall be provided within the manholes as shown on the Drawings. Annular space between the existing pipe and slot shall be made watertight with non-shrink grout. Existing pipes shall be removed within the manhole and outlets plugged watertight with non-shrink grout as shown on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All manholes and other precast structures shall be set in the dry.

B. Manholes and other precast structures shall be constructed to the dimensions as shown on the Drawings and as specified herein.

C. The base structure may be cast-in-place concrete as specified in Division 3. The concrete structure shall be placed on the required crushed stone base as shown in the Drawings over a dry sub base of structural fill that has been compacted to 95% (percent) of the maximum dry density as determined by the modified proctor test, ASTM D1557. The tops of the cast in place bases shall be shaped to mate with the precast barrel section and shall be adjusted in grade so that the top of the dome section is at the correct elevation.

D. Precast bases conforming to all requirements of ASTM C478 and other requirements for precast sections may be used and shall be set on a sub base as described above.

E. Precast concrete structure sections shall be set vertically with sections in true alignment with a 1/4-inch maximum tolerance per 5-feet of depth. The outside and inside joint shall be filled with a non-shrink mortar and finished flush with the adjoining surfaces. Allow joints to set for 24-hours before backfilling. Backfilling shall be accomplished bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with non-shrink grout to the satisfaction of the County. The Contractor shall install the precast sections in a manner that will result in a watertight joint.

F. Lift rings or non-penetrating lift holes shall be provided for handling pre-cast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation.

G. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

H. Cast iron frames shall be placed over precast concrete leveling rings, shimmed and set in cement mortar to the required grade. No more than 3 courses of leveling rings shall be used.

3.02 LEAKAGE TEST PROCEDURE FOR WASTE HOLDING TANK

A. Fill hydraulic structures to be subjected to leakage tests with water to the maximum operating liquid level line. Filling shall be at a uniform rate over a 24-hour period with continuous monitoring, or less time as required. Repair any running leaks which appear during filling before continuing.
B. After the structure has been kept full for 48 hours, it will be assumed for the purposes of the test that the absorption of moisture by the concrete in the structure is complete. Measure the change in water surface each day for a five-day period.
C. During the test period, examine exposed portions of the structure, and mark visible leaks or damp spots. Repair visible leaks or damp spots after dewatering. Repair leaks and damp spots that still exist three days after filling.
D. The determination of surface moisture evaporation shall be aided with a 24-inch-deep, white-colored, watertight container with not less than 10 square feet of surface area exposure. Position container to experience environmental conditions similar to the structure being

tested. Subtract the water loss due to evaporation from the measured water loss in the structure to determine the water loss due to leakage.

E. If the leakage is excessive, drain the structure, repair leaks and damp spots, and refill the structure and again test for leakage. Continue this process until the drop in water surface in a 24-hour period meets the test requirements.
F. Repair visible leaks and damp spots whether leakage exceeds the allowable leakage or not.
G. Make repairs and additional filling and testing (including the cost of water) at no additional cost to the County.

END OF SECTION

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SECTION 03600
GROUTING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section specifies the grouting of the annular space between the host pipe and the new liner and the grouting of the space left void in the abandonment of the existing pipelines and structures. The Work consists of furnishing all labor, equipment and materials, and performing all Work connected with the placement of the cementiceous grout to fill the void.

1.02 QUALITY ASSURANCE

A. Grouting shall be performed by a crew under the direct supervision of a superintendent that has experience in grouting of this nature.

B. Storage, mixing, handling and placement shall be in accordance with manufacturer's instructions and specifications.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. In addition, the following shall be submitted to the County for review and acceptance prior to construction.
   1. A detailed description of equipment and operational procedures to accomplish the grouting operation.
   2. Grout mixture design data, grout mixer type, grout samples, and test data.
   3. A detailed description of the grouting time schedule.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 GROUT MATERIAL

A. The grout shall be a "flowable fill" consisting of a mixture of Type 1 Portland Cement, Type "F" Flyash (ASTM 618), sand and water.

The following is a suggested trial grout mixture for a 1-cubic yard yield:
Cement: 500-pounds
Fly Ash: 500-pounds
Water: 350-pounds (42-gallons)
Sand: 2,248-pounds
Darex (W.R. Grace): 3-ounces (Air Entrainment Additive or equivalent)

The actual grout mixture to be used shall meet the minimum requirements specified below.

B. The mixture shall contain a minimum of 500-pounds cement and minimum of 400-pounds flyash per cubic yard of grout.

C. Samples of the grout mixture when set aside in a standard concrete test mold shall show less than 1% of the mixture height of free water on the surface after standing not less than 12-hours.

D. One (1) set of 3 (three) 3-inch by 6-inch sample test cubes shall be made for each mix preparation. The minimum 28-day strength shall be no less than 1,000-psi. The minimum required slump is 5-inches. The maximum allowable slump is 9-inches. Slump should be as low as practical to maintain viscosity, proper flow, and still retain the ability to pump.

2.03 EQUIPMENT

A. All grout shall be mixed with a high shear, high-energy colloidal type mixer to achieve the best uniform density.

B. The grout shall be pumped with a non-pulsating centrifugal or tri-plex pump.

C. The mixer shall be capable of continuous mixing. Batch mixing shall not be permitted.

PART 3 - EXECUTION

3.01 GROUTING OF ABANDONED PIPE

A. Where utility pipes are to remain in place (inactive) they shall be filled with a sand/cement grout as specified herein.

B. The grouting program shall consist of pumping sand-cement grout with suitable chemical additives at pressures necessary to fill the pipe sections in order to prevent the potential for future collapse.

C. Grouting of pipes shall be in sections not exceeding 300 linear feet.

D. Grout shall be placed in a maximum of 3 stages, with the initial stage volume equal to or greater than 50% of the total volume for that section of pipe being grouted. The maximum time wait between grouting stages shall be 24-hours.

E. For each stage, mix and pump the material in one continuous process so as to avoid partial setting of some grout material during that stage; thus, eliminating voids and possible subsequent surface damage due to cave-ins.

F. Each section shall be grouted by injecting grout from the lowest point and allowing it to flow toward the highest point to displace water from the annulus and assure complete void-free coverage. Grout shall be placed through tubes installed in the bulkheads at the insertion pits or manholes. Grout tubes shall be at least 2-inch nominal diameter.

G. After the ends of each section of pipe are exposed, the entire space, not to exceed 300 linear feet end to end, shall be sealed by controlled pumping of grout until it flows from the pipe at the opposite end of the grouting. Grouting shall be carried out until the entire space is filled. The ends of these sections shall be capped and/or plugged.

H. Grout pressure in the void space is not to exceed 5-psi above maximum hydrostatic groundwater level. An open ended, highpoint tap or equivalent vent must be provided and monitored at the bulkhead opposite to the bulkhead through which grout is injected. This bulkhead will be blocked closed as grout escapes to allow the pressuring of the annular space.

3.02 FIELD QUALITY CONTROL

A. The quality of the grout, application of the equipment, and installation techniques are the responsibility of the Contractor. The review and acceptance or approval of specific mix design, equipment, or installation procedures shall in no way relieve the Contractor of his obligation to provide the final product as specified herein.

B. The County may stop the grouting operations at any time if the operation does not comply with these Specifications.

END OF SECTION

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SECTION 04060

MORTAR

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Mortar for Masonry

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Joint Reinforcement

B. Metal Accessories

C. Masonry Units

D. Flashing and Steel Metal

1.03 RELATED SECTIONS

A. Section 03300 - Concrete

B. Section 04070 - Masonry Grout

C. Section 04090 - Masonry Accessories

D. Section 04340 - Reinforced Unit Masonry System

E. Section 07900 - Joint Sealants

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM) latest edition:
   1. ASTM C91 - Masonry Cement
   2. ASTM C144 - Aggregate for Masonry Mortar
   3. ASTM C150 - Portland Cement
   4. ASTM C207 - Hydrated Lime for Masonry Purposes
   5. ASTM C270 - Mortar for Unit Masonry
   6. ASTM C387 - Packaged, Dry, Combined Materials for Mortar and Concrete
   7. ASTM C595 - Blended Hydraulic Cements
   8. ASTM C780 - Standard Test Method for Prognostication and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
   9. ASTM C1142 - Extended Life Mortar for Unit Masonry
   10. ASTM C1180 - Standard Terminology of Mortar and Grout for Unit Masonry
   11. ASTM C1329 - Mortar Cement

1.05 SUBMITTALS

A. Submit data indicating specifications used for mortar.

B. Submit test reports for mortar materials indicating conformance to ASTM C270.

C. Submit test reports for field sampling and testing mortar in conformance to ASTM C780.

D. Samples: Submit two ribbons of mortar for conformance with color.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver and store manufactured products in original, unopened containers.

B. Store materials in a clean, dry location protected from dampness and freezing.

C. Store cementitious ingredients in weather-tight enclosures and protect against contamination and warehouse set.

D. Stockpile and handle aggregates to prevent contamination from foreign materials.

E. Store admixtures to prevent contamination of damage from excessive temperature changes.

F. Keep water clean and free from harmful materials.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Heat sand and/or mixing water when the air temperature is below 40° to provide mortar and grout temperatures between 40°F and 120°F.

B. Do not heat sand or water above 120°F.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

A. Cement:
   1. Portland Cement: ASTM C150, Type I or II
   2. Mortar Cement: ASTM C1329
   3. Masonry Cement: ASTM C91

B. Hydrated Lime: ASTM C207

C. Sand: ASTM C144

D. Admixtures:
   1. The use of admixtures shall not be permitted except as specified by the

Architect/Engineer and as approved by the Building Official.

2. No air entraining admixtures or material containing air entraining admixtures may be used.
3. No antifreeze compounds shall be added to mortar.
4. No admixtures containing chlorides shall be added to mortar.

E. Water:

1. Water shall be clean, potable and free from deleterious quantities of acids, alkalis and organic materials.
2. Water shall come from a domestic supply.

F. Mortar Pigment:

1. Mortar pigment shall not exceed 10% of the weight of Portland cement.
2. Carbon black shall not exceed 2% of the weight of Portland cement.

2.02 MORTAR MIXES

Mortar: ASTM C270, Type M, S, N or O.

PART 3 – EXECUTION

3.01 FIELD MIXING MORTAR

A. All cementitious materials and aggregate shall be mixed between 3 and 10 minutes in a mechanical mixer with the amount of water to produce a spreadable, workable consistency. Dry mixes for mortar which have been preblended in a factory shall be mixed at the jobsite until workable, but not to exceed 10 minutes.

B. Control batching procedure to ensure proper proportions by measuring material by volume.

C. The consistency of mortar and grout may be adjusted to the satisfaction of the mason by retempering with water. Mortar may be retempered once within 2½ hours after initial mixing to compensate for water lost due to initial evaporation. Retempering shall be done by adding water into a formed basin within the mortar and then working the mortar into the water. Mortar shall not be retempered by splashing water over the surface.

D. Discard all mortar which has begun to harden. Also discard mortar if more than 2½ hours old.

3.02 APPLICATION OF MORTAR

A. Ends of solid masonry units shall be buttered with sufficient mortar to fill head joints. Hollow unit masonry shall be mortared so that the head joint thickness is equal to the face shell thickness.

B. Mortar beds for solid units shall be slightly beveled towards the center of the wall so that the bed joints will be sufficiently filled when the masonry unit is brought into

line. Furrowing of the joints is not permitted.

C. Closures shall be rocked into place with mortared head joints against two adjacent brick in place.

D. Corners and jambs may not be pounded into position to fit stretcher units.

E. Units which have been displaced after the mortar has begun to set shall be cleaned of all mortar and reset with fresh mortar.

F. Mortar fins and protrusions which protrude more than ½ inch into cells or spaces to grouted are to be avoided.

G. Mortar Joints shall be tooled as directed in Division 4.

END OF SECTION

SECTION 04070

MASONRY GROUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

Grout for Masonry

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Reinforcing Steel

B. Metal Accessories

C. Masonry Units

D. Flashing and Steel Metal

1.03 RELATED SECTIONS

A. Section 03300 - Concrete

B. Section 04060 - Mortar

C. Section 04090 - Masonry Accessories

D. Section 04340 - Reinforced Unit Masonry Systems

E. Section 07900 - Joint Sealants

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM) latest edition:
   1. ASTM C150 - Portland Cement
   2. ASTM C207 - Hydrated Lime for Masonry Purposes
   3. ASTM C387 - Packaged, Dry, Combined Materials for Mortar and Concrete
   4. ASTM C404 - Aggregates for Masonry Grout
   5. ASTM C476 - Grout for Masonry
   6. ASTM C595 - Blended Hydraulic Cements
   7. ASTM C1019 - Standard Method of Sampling and Testing Grout

1.05 SUBMITTALS

A. Submit test reports for grout materials including conformance to ASTM C476.

B. Submit test reports for field sampling and testing grout in conformance to ASTM C1019.

1.06 DELIVERY, STORAGE AND HANDLING

A. Grout may be plant-batched and shipped to project in ready mix trucks or grout may be mixed at project site.

B. Deliver and store manufactured products in original, unopened containers.

C. Store materials in a clean, dry location protected from dampness and freezing.

D. Store cementitious ingredients in weather-tight enclosures and protect against contamination and warehouse set.

E. Stockpile and handle aggregates to prevent contamination from foreign materials.

F. Store admixtures to prevent contamination of damage from excessive temperature changes.

G. Keep water clean and free from harmful materials.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Heat sand and/or mixing water when the air temperature is below 40°F to provide mortar and grout temperature between 40°F and 120°F when used.

B. Do not heat sand or water above 120°F.

PART 2 PRODUCTS

2.01 GROUT MATERIALS

A. Portland Cement: ASTM C150

B. Hydrated Lime: ASTM C207

C. Aggregate: ASTM C404

D. Admixtures:
1. The use of admixtures shall not be permitted except as specified by the Architect/Engineer and as approved by the Building Official.
2. An admixture shall be used in high lift grouting to counteract water loss and volume reduction.

E. Water:
1. Water shall be clean, potable and free from deleterious quantities of acids, alkalis and organic materials.
2. Water shall come from a domestic supply.

2.02 GROUT MIXES

Grout: ASTM C476

A. Fine Grout (1 part Portland cement; 2¼ to 3 parts sand)

B. Coarse Grout (1 part Portland cement; 2¼ to 3 parts sand; 1 to 2 parts gravel)

C. Slump: 8 to 11 inches

D. Minimum strength 2,000 psi

PART 3 - EXECUTION

3.01 FIELD MIXING GROUT

A. All cementitious material and aggregate shall be mixed between 3 and 10 minutes in a mechanical mixer with the amount of water to produce a spreadable, workable consistency. Dry mixes for grout which have been preblended in a factory shall be mixed at the jobsite until workable, but not to exceed 10 minutes.

B. Control batching procedure to ensure proper proportions by measuring material by volume.

C. The consistency of grout may be adjusted to the satisfaction of the masonry by retempering with water.

D. Discard all grout which has begun to harden. Also discard grout which is more than 1½ hours old.

3.02 LOW LIFT GROUTING

A. Grout pours 12 inches and less:
1. If necessary, clean or roughen concrete foundation by sandblasting, chipping or other means to remove laitance.
2. Lay one course of masonry making sure no mortar extends into grout spaces.
3. Place all reinforcement which extends into grouted areas. Reinforcement shall be secured prior to grouting.
4. Grout to below one-half of the top unit height and consolidate by puddling to eliminate voids in the grout.
5. Lay an additional 12 inches of masonry units.
6. Grout each 12 inches as the units are laid. Hold the top of each grout pour approximately 1½ inches below the top of the wall. Provide at least ½ inch of grout cover above horizontal reinforcing steel.
7. At the completion of each wall, grout flush to the top of the units.
8. Remove all grout droppings as the work progresses.

B. Grout pours more than 12 inches and up to 5 feet.
1. Construct the masonry wall up to 5 feet above the foundation. Install all

reinforcing steel, anchors and embedded items as masonry work progresses.

2. For two wythe walls, bond the wythes together with rectangular ties or joint reinforcing so that one cross wire secures approximately two square feet of wall.
3. For walls that are to be partially grouted, use expanded metal mesh or other material which will not interfere with bond to restrict the grout into only those cells which are to be grouted.
4. After the mortar joints have set, grout the wall to 1½ inches below the top of the wall. Where bond beams occur, stop grout pour a minimum of ½ inch below top of masonry.
5. Consolidate the grout using a mechanical vibrator and reconsolidate after the excess water is absorbed into the masonry units.
6. Continue to lay up masonry and reinforcing steel, up to 5 feet at a time. After the mortar has set, grout and consolidate.
7. At the completion of the wall, fill the grout space flush with the top of the units and consolidate.

3.03 HIGH LIFT GROUTING

A. Construct the masonry wall up to a maximum of 24 feet above the foundation. Provide cleanout openings at the base of the wall at all vertical reinforcing bars but at a spacing no more than 32 inches on centers for solid grouted walls or a maximum of 48 inches on centers for partially grouted walls.

B. Install horizontal reinforcing steel, anchors and embedded items as masonry work progresses. Vertical reinforcing steel may be placed after the wall is constructed provided it is supported every 200 bar diameters with wire positioners or other devices to hold it in place. All reinforcement must be in place prior to grouting.

C. For two wythe walls, bond the wythes with rectangular ties or joint reinforcing so that one cross wire secures approximately two square feet of wall.

D. Install vertical grout dams at a maximum horizontal spacing of 30 feet to control the horizontal flow of grout.

For walls that are to be partially grouted, use expanded metal lath mesh or other material which will not interfere with bond to restrict the grout into only those cells which are to be grouted.

E. After the mortar joints have set, remove protruding mortar fins which excessively constrict the grout space. Remove all such droppings and debris through the cleanouts at the base of the wall.

F. After the cleanouts have been inspected, seal and brace the cleanouts.

G. Grout the walls in six foot lifts. All cells and spaces containing reinforcing steel shall be solidly grouted for partially grouted walls. For solid grouted walls, all cells shall be grouted.

H. Consolidate the grout using a mechanical vibrator and reconsolidate after the excess

water is absorbed into the masonry units.

I. Stop the grout 1½ inches below the top of the uppermost grouted unit if the grouting is to be stopped for more than one hour.

J. Continue to grout the wall in six foot lifts, consolidating and reconsolidating each lift.

K. Where additional masonry is to be laid above this point, stop the grout 1½ inches below the top of the masonry units. Otherwise, fill the grout space flush with the top of the units at the top of the wall and consolidate.

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SECTION 04090

MASONRY ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Masonry reinforcement and anchors.

B. Control and expansion joints.

1.02 RELATED SECTIONS

A. Section 03300 - Concrete

B. Section 04060 - Mortar

C. Section 04070 - Masonry Grout

D. Section 04340 - Reinforced Unit Masonry Systems

E. Section 07900 - Joint Sealants

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) latest edition:

B. ASTM A116 - Metallic Coated Steel Woven Wire Fence Fabric

C. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware

D. ASTM A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

E. ASTM A951 - Steel Wire for Masonry Joint Reinforcement

1.04 SUBMITTALS

A. Submit shop drawings of the following items:

1. Reinforcement for masonry lintels, bond beams, etc.

2. Control and/or expansion joints.

PART 2 - PRODUCTS

2.01 REINFORCEMENT

A. Reinforcement bars for lintels, bond beams, pilasters and other masonry reinforcement shall conform to ASTM A615, Grade 60.

B. Joint reinforcement shall conform to ASTM A951 and hot dipped galvanized in accordance with ASTM A153. Provide prefabricated pieces for corners and intersections of walls. Reinforcement shall be truss type approximately 2 inches narrower than the nominal thickness of the wall or partition.

C. Reinforcement used in cavity walls shall have a drip between masonry wythes.

D. Wire mesh ties shall be 16 gage or larger diameter zinc-coated steel wire woven into ½-inch mesh and cut into strips 1-inch narrower than the width of walls in which they are used. Zinc-coating shall conform to ASTM A116, Class 2 or 3 coating.

2.02 RIGID STEEL ANCHORS

Rigid steel anchors shall be a minimum of 1" x 1/4" x 26" long with each end turned up not less than 2 inches. Anchors shall be zinc-coated conforming to ASTM A116, Class 2 or 3.

2.03 SEALS AND GASKETS FOR CONTROL AND EXPANSION JOINTS

Seals and gaskets for control and expansion joint shall be of closed cell natural or synthetic rubber. Provide seals and gaskets of indicated shapes and in locations as specified or indicated on Drawings. Seals and gaskets shall be resistant to oils and solvents and shall be flexible after being exposed to temperature of minus 40° F.

2.05 WIRE TIES

A. Wire ties shall be fabricated from 3/16-inch diameter zinc-coated steel wire conforming to ASTM A116, Class 2 or 3 coating. Ties shall be at least 4 inches wide and embedded 4 inches into backup material, unless otherwise indicated on the Drawings.

B. Ties used in cavity walls shall have a drip between masonry wythes.

PART 3 - EXECUTION

3.01 JOINT REINFORCEMENT

A. Install horizontal continuous joint reinforcement in all unit masonry walls, back-ups, and partitions. Reinforcement shall start not more than 8 inches above the masonry supporting surface and end within the top full mortar joint, or as indicated on the Drawings, and shall be spaced at maximum 16-inch centers vertically.

B. Reinforcement shall be placed in the first three mortar joints above lintels and below openings. Extend the reinforcement at least 24 inches past jambs. In addition, provide wire ties alternating with reinforcement 16 inches on centers vertically and within 12 inches of opening jambs.

C. Reinforcement shall be continuous but shall not pass through vertical masonry expansion or control joints unless otherwise shown on the Drawings. Side rods of horizontal joint reinforcement shall be lapped at least 6 inches at splices.

D. Joint reinforcement shall be placed in a manner to assure 5/8-inch mortar cover on the exterior face of walls and 1/2-inch mortar cover on interior faces.

E. At intersections bond each course with wire mesh ties or prefabricated joint reinforcement spaced not to exceed 16 inches vertically.

3.02 VERTICAL REINFORCEMENT

Install vertical reinforcement bars in the hollow cores of masonry units where indicated on the Drawings. Fill all cells containing reinforcement with masonry grout or Class A concrete for the full height of the reinforcement.

3.03 ANCHORAGE

A. All masonry unit partitions that abut exterior walls, except when control joints occur at such locations, shall be anchored once every 16 inches vertically with rigid steel anchors. Anchors shall extend at least 4 inches into wall and not less than 18 inches into partition.

B. When intersecting walls are carried up separately, the vertical joint shall be regularly toothed or bonded with 8-inch offsets and the joints provided with rigid steel anchors spaced not more than 24 inches apart vertically.

C. At intersecting partitions, the vertical joint shall be tied with wire mesh ties spaced at 16 inches vertically.

END OF SECTION

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SECTION 04340

REINFORCED UNIT MASONRY SYSTEM

PART 1 - GENERAL

1.01 GENERAL

A. Related Sections: General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this section.
   1. Section 03200 - Concrete Reinforcement
   2. Section 04060 - Mortar
   3. Section 04070 - Masonry Grout

B. Work Includes: Structural load bearing concrete masonry units, defined as all concrete masonry walls shown on the structural drawings. Liquid polymeric admixture added to the concrete masonry units at the time of manufacture. Mortar and liquid polymeric admixture added to the mortar for wall construction at the time of mixing. Jointing and cleaning.

1.02 QUALITY ASSURANCE

A. Codes and Standards
   1. ANSI/ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement
   2. ANSI/ASTM C55 - Concrete Building Brick
   3. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
   4. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process
   5. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement
   6. ASTM C90 - Hollow Load Bearing Concrete Masonry Units
   7. IMIAC - International Masonry Industry All-Weather Council; Recommended Practices and Guide Specifications for Cold Weather Masonry Construction
   8. ACI 531 - Building Code Requirements for Concrete Masonry Structures.
   9. ASTM E 514, “Standard Test method for Water Penetration and Leakage through Masonry.”
   10. ASTM C 1357, “Standard Test Method for Evaluating Masonry Bond Strength.”
   11. ASTM C 1314, “Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.”
   12. ASTM C 1148, “Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar.”
   13. ASTM C 426, “Standard Test Method for Drying Shrinkage of Concrete Masonry Units.”
   14. CMU producer shall be qualified by manufacturer of integral CMU water-repellent admixture.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with General Conditions of the Contract for Construction. Submit shop drawings indicating bars sizes, spacings, locations,

quantities of reinforcement, bending and cutting schedules, supporting and spacing devices.

B. Submit product data for masonry units and fabricated wire reinforcement. Submit samples under provisions of Section 01300. Submit manufacturer's certification that products meet or exceed specified requirements.

C. Spec-Data® Sheet on Grace Construction Products DRY-BLOCK System of Integral Water-Repellent Admixtures for Block and Mortar.

D. Data Sheet on DRY-BLOCK II Mortar Admixture.

E. Technical Bulletin on Cleaning Masonry Containing DRY-BLOCK.

F. Test Reports prepared by a qualified independent laboratory indicating compliance with the performance requirements for integral mortar water-repellency as tested using:
   1. ASTM E 514, extended to 72 hours.
   2. ASTM C 1357.
   3. ASTM C 1314.
   4. ASTM C 1148.
   5. California State Chapter 2405(c) 3.C test for Grout Shear Bond Strength.

G. Current “Qualified Producer Certification” issued by manufacturer of integral CMU water-repellent admixture, indicating that CMU producer is qualified to produce CMU units containing manufacturer’s admixture.

H. Sample Panel: Construct a sample panel to determine the compatibility of materials and the effect of the materials and construction procedures on the final appearance of the wall. Use jobsite materials, including specified water-repellent CMU and mortar to construct sample panel. The CMU sample panels erected shall represent the range of texture and color permitted for the project. Prepare more than one sample batch of mortar, especially when coloring pigments are added to the mortar, to establish desired aesthetics and performance. Perform all construction procedures on sample panel, including cleaning and application of coatings and sealants. Retain sample panel during construction as standard for judging completed masonry work. Acceptance of sample panel does not constitute approval of deviations from materials contained in sample panel, unless such deviations are specifically approved by Architect in writing.

1.04 DELIVERY, STORAGE AND HANDLING

A. Masonry units delivered to the site must comply with acceptable moisture content limitations. Store units above ground. Store on platform, which permits air circulation. Cover and protect units against moisture.

B. Store integral water-repellent mortar admixture in an area where temperature is maintained between 4ºC (40ºF) to 38ºC (100ºF).
   1. Do not allow integral water-repellent mortar admixture to freeze; discard any frozen admixture.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.

1.06 WARRANTY

A. Integral CMU water-repellent admixture shall be warranted by admixture manufacturer to be free of defects and to meet manufacturer's published physical and chemical properties.

B. CMU producer shall warrant that integral CMU water-repellent admixture has been provided at appropriate dosage rate in all CMU units shipped to project site for use in exterior wall construction.

C. Installer shall warrant that only CMU containing integral CMU water-repellent admixture have been placed in exterior CMU walls.

D. Integral water-repellent mortar admixture shall be warranted by admixture manufacturer to be free of defects and to meet manufacturer's published physical and chemical properties.

E. Installer shall warrant that only mortar containing integral water-repellent mortar admixture at the manufacturer's recommended addition rate has been placed in exterior walls.

PART 2 - PRODUCTS

2.01 MASONRY UNITS

A. Hollow load bearing masonry conforming to ASTM C-90-90, Grade N of standard sizes as shown on drawings. No broken or chipped block permitted. Moisture content should not exceed 50% of total absorption. Net cross sectional area - 50% of gross.

B. Standard masonry unit shall be square ended block such that cores align vertically for unobstructed grouting. The only exception is listed below

C. Masonry units: Nominal modular size as shown on the drawings. Provide special units for bond beams and lintels.

D. Integral CMU Water-Repellent equivalent to DRY-BLOCK Block Admixture, an integral liquid polymeric water-repellent CMU admixture manufactured by Grace Construction Products:
   1. Description: Integral liquid polymeric admixture mixed with concrete during production of CMU.
   2. Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.
   3. Flexural Bond Strength of Masonry: An increase of minimum 10% in masonry flexural bond strength shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar tested according to ASTM C 1357.

4. Compressive Strength of Masonry Prisms: Maximum 5% decrease in compressive strength of prisms shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1314.
5. Drying Shrinkage of CMU: Maximum 5% increase in drying shrinkage of the CMU shall occur as a result of adding integral water-repellent CMU admixture when compared to a control (containing no admixtures) CMU when tested according to ASTM C 426.
6. Grout Shear Bond Strength: Maximum 5% decrease in grout shear bond strength shall occur as a result of adding integral water-repellent admixture to the CMU compared to a control (containing no admixtures) CMU when tested according to California State Chapter 2405(c)3.C test for Grout Shear Bond Strength.

2.02 MORTAR

A. Conform to "Tentative Specifications for Mortar for Unit Masonry" ASTM C-270, Type S, property specifications. All ingredients shall meet appropriate ASTM Specifications. Water: Potable.

B. Mixing: All mortar shall be thoroughly mixed for a period of at least five minutes after all materials are in mixer designed for this purpose. These requirements shall not be waived except for minor jobs and then only upon the written approval of the County's Representative.

C. Time Limit: All mortar to be used and placed in final position within 2-/12 hours after mixing with air temperature is 80 degrees F or higher and within 3-1/2 hours when air temperatures is less than 80 degrees F. Mortar not used within these time limits shall be discarded.

D. Retempering: Mortar that has stiffened within the allowable time limit because of evaporation of moisture may be retempered to restore workability by adding water.

E. Integral Water-Repellent Mortar Admixture equivalent to “DRY-BLOCK” Mortar Admixture, an integral water-repellent mortar admixture manufactured by Grace Construction Products.
1. Description: Integral liquid polymeric admixture for mortar added during mixing.
2. Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.
3. Flexural Bond Strength of Masonry: An increase of minimum 10% in masonry flexural bond strength shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1357.
4. Compressive Strength of Masonry Prisms: Maximum 5% decrease in compressive strength of prisms shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1314.
5. Drying Shrinkage of Mortar: Maximum 5% increase in shrinkage of mortar shall occur as a result of adding integral water-repellent mortar admixture when compared to a control (containing no admixture) mortar when tested according to ASTM C

1148.

2.03 REINFORCEMENT AND ANCHORAGE

A. Joint Reinforcement: Ladder type; hot-dip galvanized after fabrication cold-drawn steel conforming to ANSI/ASTM A82, 3/18 inch side rods with 9 gage cross ties. Finish to be galvanized with 0.4 ounces of zinc Class 1. Use 3 wire Type (tripod) in cavity walls and 2 wire in single width walls. Provide prefabricated corner and tee units.

B. Acceptable Manufacturers: Hohmann & Barnard, Duro-Wall, Masonry Reinforcing Corporation of America, TY-Wall, AA Wire Products Company.

PART 3 - EXECUTION

3.01 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other Sections. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.03 PLACING AND BONDING

A. Lay all masonry units in a "full" bed of mortar. Buttering corners of joints or excessive furrowing of mortar joints are not permitted. Remove excess mortar as work progresses. Interlock intersections and external corners.

B. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Cut mortar joints flush where ceramic or quarry wall tile is scheduled, cement parging is required.

3.04 INTEGRAL WATER-REPELLENT

A. Integral Water-Repellent CMU and Mortar Admixture:

1. Installer shall use only concrete masonry units containing compatible integral water-repellent CMU admixture for exterior wall construction.
2. Installer shall use only mortar containing integral water-repellent mortar admixture at the manufacturer’s recommended addition rate and mixed according to the manufacturer’s recommended instructions.
3. Fill head and bed joints for full thickness of the faceshells to provide the greatest

resistance to water penetration.

4. Tooling:
   a. Tool the mortar joints concave or to a V-profile to provide the greatest resistance to water-penetration. Do not use raked, flush, extruded, struck, beaded, weathered, or other joint profiles due to their reduced water-resistance.
   b. Tool the mortar joints when they are thumbprint hard to provide the greatest resistance to water-penetration and to help minimize hairline cracks between the mortar and the CMU.
5. Cover the top of unfinished masonry work to protect it from the weather and to prevent accumulation of water in the cores of the CMU.
6. Cleaning:
   a. Remove "primary" efflorescence from masonry walls exposed in the finished work in accordance with the manufacturer's recommendations and the NCMA TEK Bulletin #8-3A.
   b. Remove dirt or stains from masonry walls exposed in the finished work in accordance with the manufacturer's recommendations and the NCMA TEK Bulletin #8-2A.
   c. Promptly remove excess wet mortar containing integral water-repellent mortar admixture from the face of the masonry as work progresses. Do not use strong acids, overaggressive sandblasting or high-pressure cleaning methods.
   d. Comply with applicable environmental laws and restrictions.
7. At least two weeks before starting above-grade masonry work, schedule a pre-installation conference at the to discuss compliance with the requirements of the contract documents. Give two weeks advance notice to the participants, including the contractor, mason contractor, flashing installer, CMU producer and/or the manufacturer of the integral water-repellent mortar admixture. Advise the architect of the scheduled meeting date.

3.05 REINFORCEMENT AND ANCHORAGES

A. Install horizontal joint reinforcement at a maximum spacing inches o.c. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening. Lap joint reinforcement ends minimum 12 inches.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position. Embed anchors embedded in concrete. Embed anchorages in every second block joint.

C. Reinforce joint corners and intersections with a vertical #4 bar grouted in the cell at the intersection and one cell each side of the intersection.

3.06 REINFORCEMENT AND GROUTING

A. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed. Place mortar in masonry unit bed joints back 1/4 inch (6 mm) from edge of unit grout spaces, bevel back and upward. Reinforce masonry unit cores with reinforcement bars and grout.

B. Retain vertical reinforcement in position at top and bottom and at intervals not exceeding 192 bar diameters. Lap splices in deformed reinforcing bars shall be 48 bar diameters minimum. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout space 2 inches or greater in width with course grout using high or low lift grouting techniques.

C. When grouting is stopped for more than one hour, terminate grout 1-1/2 inches below top of upper masonry unit to form a positive key for subsequent grout placements.

D. Low Lift Grouting: Place first lift of grout to a height of 16 inches and rod for grout consolidation with a 1 inch by 2 inch wood stick or a mechanical vibrator. Place subsequent lifts in 8-inch increments and rod for grout consolidation.

E. High Lift Grouting: Provide clean out opening no less than 4 inches high and 12 square inches in area at the bottom of each cell to be grouted by cutting one face shell of masonry unit below the top of floor slab so that repair is not visible in the finished construction. Do not use high lift grouting until masonry units have been in place 72 hours. Remove mortar fins protruding more than 1/2 inch into the grout space by dislodging the projections with a rod or stick as the work progresses or by washing the grout space at least twice a day during erection using a high-pressure stream of water.

F. Clean masonry cells or mortar droppings and other foreign materials. Request the Inspector to inspect the cells. Allow 3 days advance notice of inspection. After cleaning and cell inspection, seal openings. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.

G. Limit grout lift to 60 inches and rod for grout consolidation. Wait a minimum of 30 minutes and a maximum of 60 minutes before placing next lift. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidated with the vibrator extending 12 to 18 inches into the previous lift. Do not insert vibrators into lower pours that are in a semi-solidified state. Repeat the waiting, pouring, and consolidating process until the top of the grout pour is reached. Reconsolidate the top our after the required waiting period.

3.07 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints. Form control joint with a sheet building paper bond breaker, fitted to one side of the hollow contour end of the block unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant. Size control joint in accordance with Section 07900 for sealant performance. Form expansion joint as detailed.

3.08 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other Sections of work to provide correct size, shape and location. Obtain Architect/Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired. Cutting may only be done with a power saw.

3.09 CLEANING

A. Clean work under provisions of Section 01700. Remove excess mortar and mortar smears. Replace defective mortar. Match adjacent work. Clean soiled surfaces with cleaning solution. Use non-metallic tools in cleaning operations.

3.10 PROTECTION OF FINISHED WORK

A. Protect finish installation. Without damaging completed work, provide protective boards at exposed external corners, which may be damaged by construction activities.

END OF SECTION

SECTION 05025

METAL MATERIALS, METHODS AND FASTENING

PART 1 - GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere:

A. This Section includes the basic materials and methods required for the work of Division 5, Metals.

B. Related Work Specified Elsewhere - Painting - Section 09900

PART 2 - PRODUCTS

2.01 STEEL

A. Steel shall comply with ASTM A992 for W shapes, and ASTM A36 for M, S, C, MC, L and plates, rods and bars unless otherwise specified.

B. Structural steel tubing shall comply with ASTM A500, Grade B or ASTM A501.

C. Steel pipe shall comply with ASTM A53, Grade B.

2.02 STAINLESS STEEL

Stainless steel shall comply with ASTM A167, type 316.

2.03 ALUMINUM

A. Aluminum for structural and rolled shapes shall be Aluminum Association alloy 6061-T6.

B. Aluminum for extruded shapes shall be Aluminum Association alloy 6063-T6.

C. Aluminum for pipe shall be Aluminum Association alloy 6063-T6.

D. Aluminum for castings shall be Aluminum Association alloy F-514, or approved equal.

2.04 CAST IRON

A. Gray iron for castings shall comply with ASTM A48, Class 30 or approved equal.

B. Malleable iron castings shall be made of high grade white iron, fully annealed, of uniform ductile strength and shall comply with ASTM A197.

2.05 BOLTS

A. High strength bolts shall comply with ASTM A325 with suitable nuts and washers,

complying with ASTM A354, Grade BC.

B. Anchor bolts and connection bolts for steel assemblies shall comply with ASTM A307.

C. Anchor bolts and connection bolts for aluminum shall be stainless steel.

2.06 WELDING ELECTRODES

Filler metal for welding shall comply with AWS D1.1, Structural Welding Code.

2.07 GROUT

Grout for bedding and grouting structural steel shall be non-shrink grout as specified in Section 03600.

2.08 FABRICATION

A. General
   1. Fabricate all metal parts to comply with the design indicated on the Drawings. Make field measurements and prepare templates as required to ensure proper fit. Assemblies shall be fitted together in the shop and delivered to the site complete and ready for installation.
   2. Form metal shapes with sharp lines and angles, and finish with smooth surfaces. Shearings and punchings shall be clean and true. In general, holes for bolts shall be drilled or reamed 1/16_inch larger than the diameter of the bolt. Holes for anchor bolts shall be 1-1/3 times the anchor bolt diameter.
   3. Metal thicknesses, assembly details, and supports shall provide ample strength and stiffness. Joints shall be designed to prevent trapping of moisture.

B. Shop Coatings
   1. Prepare and shop prime ferrous metal in compliance with Section 09900. Do not shop prime stainless steel, aluminum, galvanized or plated metals, bronze, or machined bearing surfaces.
   2. Anchors, sleeves, and metal parts built into masonry or concrete shall be galvanized or coated with a bituminous paint.
   3. Castings for exterior exposure shall be cleaned and coated with coal-tar-pitch varnish.
   4. Hot-dip galvanizing for products fabricated from steel shapes, plates, bars, and strips shall comply with ASTM A123. Hot-dip galvanizing for assembled steel products shall comply with ASTM A386. Except for bolts and nuts for field assembly, galvanize all subassemblies immediately after fabrication. Hardware shall be galvanized in compliance with ASTM A153.
   5. Aluminum in direct contact with dissimilar metals, concrete, or masonry shall be coated with a heavy-bodied bituminous paint or covered with non-absorptive insulating tape or gasket.

C. Fasteners and Connections
   1. Provide fastening devices as required and in compliance with the Drawings and shop drawings. Provide welded shop connections or concealed fastenings wherever practicable.

2. Power-driven fasteners shall be of the types and sizes recommended by the manufacturer for the particular application. Power-driven fasteners that will be exposed to view shall be set through a steel finishing disc. When set in concrete or masonry, the minimum penetration of power-driven fasteners shall be six times the diameter of the shank.
3. Structural joints made using high strength bolts, hardened washers, and nuts tightened to a high bolt tension shall comply with the "Specification for Structural Joints Using ASTM A325 or A490 Bolts", issued by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
4. Welded joints shall comply with AWS D1.1, Structural Welding Code, and AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings". All welds shall be made by operators who have been previously qualified as prescribed by AWS B3.0, Welding Procedure and Performance Qualification. All welds exposed to view shall be dressed smooth.
5. Anchor holes in concrete or masonry for grouted bolts shall be a minimum of 1-1/2 times the bolt shank diameter. Anchor holes in concrete and masonry for expansion type anchor bolts shall comply with the bolt manufacturer's recommendations.
6. Screw heads shall be countersunk. Bolt threads shall be nicked to prevent nut loosening.

2.09 TEMPLATES, LEVELING PLATES, AND APPURTENANCES

Provide all templates, leveling plates, and appurtenances required for the installation of metal work.

END OF SECTION

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SECTION 05500

MISCELLANEOUS METALS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This section specifies the labor, materials, equipment, and incidentals required and installation of covers, grates, frames, hatches, manhole rungs, catch basin castings, and other miscellaneous metals as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. The work in this section shall be coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades that adjoin items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.

1.03 SHOP DRAWINGS AND SAMPLES

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Submit detail drawings showing sizes of members, method of assembly, anchorage, and connection to other members for all products provided under this section to the County for approval before fabrication.

C. One (1) product sample of each type of product shall be submitted to the County upon request. Samples shall be submitted for concurrent review with Shop Drawings.

1.04 REFERENCE STANDARDS

Unless otherwise specified, materials shall conform to the following:

Structural Steel	ASTM A992 and A36
Welded and Seamless Steel Pipe	ASTM A53
Gray Iron Castings	ASTM A48, Class 30
Galvanizing, general	ASTM A123
Galvanizing, hardware	ASTM A153
Galvanizing, assemblies	ASTM A386
Aluminum (Extruded Shapes)	6061 T6 (Alum. alloy)
Aluminum (Extruded Pipe)	6063 T6 (Alum. alloy)
Aluminum Bar Structural	6061 T6 (Alum. alloy)
Bolts and Nuts	ASTM, A325
Stainless Steel Bolts, Fasteners	AISI, Type 316
Stainless Steel Plate and Sheet, Wire	AISI, Type 316
Welding Rods for Steel	AWS Spec. for Arc Welding

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 ANCHORS, BOLTS, AND FASTENING DEVICES

A. Anchors, bolts, and other fastening devices shall be furnished as necessary for installation of the work of this Section.

B. Compound masonry anchors shall be of the type shown or required and shall be Star Slug compounded masonry anchors manufactured by Star Expansion Industries, by Phillips Drill Co., Rahplug, or acceptable equal. Anchors shall be minimum "2-unit" type.

C. The bolts used to attach the various members to the anchors shall be the sizes shown or required. Stainless steel shall be attached to concrete or masonry by means of stainless steel machine bolts and iron or steel shall be attached with steel machine bolts unless otherwise specifically noted.

D. For structural purposes, unless otherwise noted, expansion bolts shall be Wej it "Ankr Tite", Phillips Drill Co. "Wedge Anchors", Hilti "Kwik Bolt", or acceptable equal. When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete.

E. Materials for anchor or expansion bolts shall be as noted on the Drawings. If no specific material is listed, hot dipped galvanized steel shall be used. All hardware inside wetwells,

manholes, or other wetted areas shall be 316 Stainless Steel.

F. Unless otherwise noted, adhesive anchors shall be a two-component chemical resin anchoring system. Capsules shall be self-contained, exactly premeasured amounts of polyester or vinyl ester resin, aggregate and hardener. Stud assemblies shall consist of a stainless steel type 316 all-thread anchor rod with nut and washer. Provide manufacturer's recommended installation tools for installing anchor components. Install anchors in full compliance with the manufacturer's recommendations. Adhesive anchor system shall be Hilti, HIT-RE 500-SD; Simpson Strong Tie, SET-XP Epoxy-Tie or Acrylic Tie; or approved equal.

G. Anchors used in masonry construction shall be as indicated in Section 2.02.F above where anchors are installed into solid grouted cells. Additional, Hilti, HIY-HY150 MAX adhesive anchoring system, or approved equal, may also be used in grouted masonry construction. When fastening to hollow concrete block or brick, adhesive anchors shall be a three-part stud, screen and chemical dispenser anchoring system. Adhesive cartridges shall contain premeasured amounts of resin and hardener which are mixed and deposited in a screen tube by a dispenser. Stud assemblies shall consist of a stainless steel type 316 all-thread anchor rod with nut and washer. Anchors shall be Hilti, HIT HY-20 System or approved equal.

2.03 ALUMINUM ITEMS

B. Prefabricated checker plate aluminum hatches shall be as specified in Appendix D "List of Approved Products" appended to these technical specifications.

A Hatches with any single dimension over 3-feet 6-inches shall be double leaf type. Hatches shall be designed for a live load of 300-pounds per square foot. Hatches shall be watertight.

B Check plate aluminum cover plates shall be fabricated to the details shown and installed at the locations shown.

C Miscellaneous aluminum shapes and plates shall be fabricated as shown. Angle frames for hatches, beams, grates, etc., shall be furnished complete with welded strap anchors attached. Furnish all miscellaneous aluminum shown but not otherwise detailed. Structural shapes and extruded items shall conform to the detail dimensions or the plans within the tolerances published by the American Aluminum Association.

2.04 STEEL ITEMS

A Sleeves shall be steel or cast iron pipe in walls and floors with end joints as shown on the Drawings. All pipe sleeves shall have anchors centered on the circumference as shown.

B Miscellaneous steel pipe for sleeves, lifting attachments, and other uses as required shall be Schedule 40 pipe fabricated according to the details as shown on the Drawings.

2.05 CAST IRON ITEMS

A. Outside pipe clean out frames and covers shall be heavy duty, R 6013 R 6099 series as manufactured by Neenah Foundry Co., or acceptable equal. All outside pipe cleanouts shall be 6-inch diameter.

B. Trench drain shall be of length shown on the Drawings and shall be heavy duty, cast iron, open grate lid type, Series R 4990 Type A as manufactured by Neenah Foundry Co., or acceptable equal.

C. Gray iron castings for manhole frames, covers, adjustment rings, and other items shall conform to ASTM A48, Class 30B. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the Drawings. All manhole frames and covers shall be traffic bearing to meet AASHTO H 20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevation.

2.06 GRATING

Grating shall be aluminum as indicated in the drawing. Main bars shall be of the thickness and of the depth indicated in the drawings. Submit manufacturers load tables for grating selected for Engineer's approval.

2.07 FRAMES AND SUPPORTS FOR GRATING AND CHECKERED PLATES

Fabricated frames and supports for grating and checkered cover plates shall be as indicated in the drawings. Corners of embedded angle frames shall be mitered and welded with the welds ground smooth.

2.08 WELDING ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

B. Welding electrode for aluminum shall be ER4043 filler metal.

C. Welding electrodes for stainless steel shall conform to AWS A5.4. Use electrodes as follows:

Stainless Steel Material	**Welding Electrode Material**
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

PART 3 – EXECUTION

3.01 FABRICATION

A. All miscellaneous metalwork shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by the fitting.

C. Welded joints shall be rigid and continuously welded or spot-welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.

D. Welding of parts shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the County. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS code. Component parts of built up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.

F. All aluminum finish exposed surfaces, except as specified below, shall have manufacturers' standard mill finish. Aluminum handrails shall be given an anodic oxide treatment in accordance with the Aluminum Association Specification AA C22 A41. A coating of methacrylate lacquer shall be applied to all aluminum before shipment from the factory.

G. Castings shall be of good quality, strong, tough, even grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the County. All finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95% (percent) of the theoretical weight computed from the dimensions shown. The Contractor shall provide facilities for weighing castings in the presence of the County showing true weights, certified by the supplier.

H. All steel finish work shall be thoroughly cleaned of all loose mill scale, rust, and foreign matter before shipment and shall be given 1 shop coat of primer. Abrasions in the field shall be touched up with primer immediately after erection. Final painting shall be in accordance with Section 09900 "Painting."

I. Galvanizing shall be the hot dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and

completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2-ounces per square foot of surface.

3.02 INSTALLATION

A. Install all items furnished except items to be imbedded in concrete or masonry, which shall be installed under Division 3 or Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.

B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

C. Where aluminum is embedded in concrete, apply a heavy coat of approved bitumastic troweling mastic in accordance with the manufacturer's instructions prior to installation.

D. Where aluminum contacts masonry or concrete, provide a 1/32-inch neoprene gasket between the aluminum and the concrete or masonry.

E. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc chromate primer and provide a 1/32-inch neoprene gasket between the aluminum and the dissimilar metal.

F. Where aluminum contacts wood, apply 2 coats of aluminum metal and masonry paint to the wood.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Preservative treated wood materials.

B. Miscellaneous framing and sheathing.

C. Communications and electrical room mounting boards.

D. Concealed wood blocking, nailers, and supports.

E. Miscellaneous wood nailers, furring, and grounds.

1.03 REFERENCES

A. AFPA T10 - Wood Frame Construction Manual; American Forest and Paper Association; 2001.

B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2007.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.04 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials and application instructions.

B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

B. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

1.07 DELIVERY, STORAGE AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 EXPOSED DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

2.03 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Southern Pine.

E. Grade: No. 2, 2 Common, or Construction.

2.04 ACCESSORIES

A. Fasteners and Anchors:

   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:

1. Manufacturers:
   a. Chemical Specialties, Inc: www.treatedwood.com.
   b. Substitutions: See Section 01600 - Product Requirements.

C. Preservative Pressure Treatment of Lumber Above Grade: AWPA Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25lb/cu ft retention.

1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

3.04 BLOCKING, NAILERS and SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

D. Specifically, provide the following non-structural framing and blocking:

1. Joints of rigid wall coverings that occur between studs.

3.05 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch

Structural Steel	ASTM A36
Welded and Seamless Steel Pipe	ASTM A53
Gray Iron Castings	ASTM A48, Class 30
Galvanizing, general	ASTM A123
Galvanizing, hardware	ASTM A153
Galvanizing, assemblies	ASTM A386
Aluminum (Extruded Shapes)	
6061 T6 (Alum. alloy)	
Aluminum (Extruded Pipe)	6063 T6 (Alum. alloy)
Aluminum Bar Structural	6061 T6 (Alum. alloy)
Bolts and Nuts	
ASTM, A307	
Stainless Steel Bolts, Fasteners	AISI, Type 316
Stainless Steel Plate and Sheet, Wire	AISI, Type 316
Welding Rods for Steel	AWS Spec. for Arc Welding

in 30 feet maximum.

3.06 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01732.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 07190

WATER REPELLENT COATING

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Volatile Organic Compound (VOC) compliant water-based penetrating sealer field applied to completed exterior DRY-BLOCK CMU wall construction to:
   a. Further prevent intrusion of water into completed wall.
   b. Reduce attack from water-borne contaminants.
   c. Minimize the occurrence of efflorescence, mold, mildew, and algae.

B. Related Sections:

1. Section 04340 – Reinforced Unit Masonry System - Masonry substrate.

1.02 PERFORMANCE REQUIREMENTS

A. ASTM E 514, "Standard Test Method for Water Penetration and Leakage through Masonry."

B. VOC Content: EPA Method 24.

C. ASTM E 96, "Test Methods for Water Vapor Transmission of Materials."

D. Water Repellency Test – Capillary Test: "Grace Construction Products, Method 698."

E. Water Repellency Test – 63.5 mm (2½ in.) Hydrostatic Head: "Grace Construction Products, Method HU 698."

F. Accelerated Weathering: QUV (2,000 hours).

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Reduce absorption of water and waterborne contaminants into substrate.
2. Permit water vapor transmittance.
3. No change to slight darkening of substrate after application.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300

1. Spec-Data® Sheet on Grace Construction Products INFINISEAL DB Water-Repellent Sealer for DRY-BLOCK Admixture Wall Systems.
2. Technical Brochure on Grace Construction Products INFINISEAL DB Water-Repellent Sealer.
3. Test Report prepared by a qualified independent laboratory indicating compliance

with the performance requirements for water-repellent sealer compatible with the integral water-repellent admixture wall system as tested using ASTM E 514, extended to 72 hours.

4. Technical data sheet indicating compliance with the performance requirements for water-repellent sealer compatible with the integral water-repellent admixture wall system as tested using:
   a. EPA Method 24.
   b. ASTM E 96.
   c. "Grace Construction Products Method 698."
   d. "Grace Construction Products Method HU 698."
   e. QUV for 2,000 hours.
5. Material Safety Data Sheets (MSDS) for water-repellent sealer maintained on project site during application period.

1.05 QUALITY ASSURANCE

A. Mockups:

1. Perform application test to 1.5 m x 1.5 m (5 ft x 5 ft) section of CMU wall surface to determine:
   a. Proper sealer coverage rate for type of CMU being sealed. Typical sealer coverage rate ranges from 1.2 to 3.7 m2/L (50 to 150 ft2/gal). Where overall coverage rates are less than 1.9 m2/L (80 ft2/gal), use 2-coat application method.
   b. Desired water-repellency properties.
   c. Desired surface appearance after sealer is fully dry.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in a dry area at a temperature between 40º and 100º F (0 to 38 degrees C). Provide adequate ventilation and keep away from ignition sources.

B. Do not allow water-repellent sealer to freeze; discard any frozen sealer.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:
1. Do not apply water-repellent sealer when wall surface, air, and sealer temperatures are less than 4°C (40°F) or greater than 38°C (100°F).
2. Do not apply if rain or temperatures below 40 degrees F (4 degrees C) are expected within 6 hours after application.
3. Do not apply during winds that could carry water repellent to adjacent surfaces, properties, or vegetation.
4. Do not apply sooner than 24 hours after surface has been exposed to rain or other water source.

B. Substrate:
1. Cured minimum 30 days.
2. Not frozen or frost covered.
3. Clean, sound, and dry.

C. Ensure adequate ventilation in application areas.

D. Joint sealers, paints, and glazing compounds and sealants fully cured.

1.08 SEQUENCING

A. Apply water repellents after installation of joint sealers.

1.09 WARRANTIES

A. Provide manufacturer's 5 year material replacement warranty.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Manufacturer:

Grace Construction Products
62 Whittemore Avenue
Cambridge, MA 02140
www.graceconstruction.com

Professional Products of Kansas, Nc.
www.watersealant.com

2.02 MATERIALS

A. Water Repellent Product: INFINISEAL DB Water-Repellent Sealer manufactured by Grace Construction Products.

1. Description: Specially-formulated, VOC-compliant, clear, penetrating sealer consisting of water-based blend of silanes and siloxanes to provide maximum water-repellency when post-applied to integrally water-repellent-treated CMU wall construction.
2. Water Permeance: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.
3. Volatile Organic Compound Content: Maximum 320 g/L.
4. Moisture Vapor Transmission Rate: Minimum 95% compared to unsealed normal weight integral water-repellent sample using ASTM E 96.
5. Depth of Penetration: 15 mm (9⁄16 in.) to 35 mm (13⁄8 in.) depending on density of CMU, as observed visually.
6. Water Repellency – Capillary Test: Minimum 82% reduction in water uptake versus unsealed normal weight integral water-repellent CMU using Method 698.
7. Water Repellency – 63.5 mm (21⁄2 in.) Hydrostatic Head Pressure: Minimum 86% reduction in water uptake versus unsealed normal weight integral water-repellent CMU using Method HU 698.
8. Accelerated Weathering: Minimal color change using QUV for 2,000 hours.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation:

1. Ensure surface area of CMU to be treated is clean and dry, free of chemical cleaners, efflorescence, dirt, oils, mortar smears, and other surface contaminants.
2. Repoint any loose, cracked, or disintegrated mortar a minimum of 7 days before applying water-repellent sealer.
3. Ensure all joint sealants and caulking is fully cured.

B. Surrounding Area Protection:

1. Take necessary precautions to protect all areas surrounding surfaces to be treated with water-repellent sealer, including masking windows and metals, and covering plants, grass, and any other non-CMU surfaces with either polyethylene sheeting or drop cloth materials before and during sealer application.
2. Take necessary safety precautions to keep all personnel not involved in application of water-repellent sealer and pedestrians away from application area.
3. Avoid overspray by wind drift and/or improper application procedures.

3.02 APPLICATION

A. Spray Application:

1. Use low-pressure airless spray equipment fitted with fan tip between 0.6 mm (0.025 in.) and 0.8 mm (0.035 in.).
2. Apply at lowest pressure setting that ensures continuous spray without surge.
3. Using 0.9 m to 1.2 m (3 ft to 4 ft) wide swathes, start spraying from bottom of CMU wall and work to top of wall, avoiding spray atomization and applying sufficient material to saturate CMU wall with maximum 150 mm (6 in.) sealer rundown.
4. When necessary, apply second coat, wet-on-wet, at twice the coverage rate as first coat within one hour of first spray application, per pre-application testing to ensure proper surface saturation, coverage, and product performance.

B. Brush or Roller Application:

1. Use either nylon or other synthetic brushes or rollers resistant to alkalinity.
2. Apply water-repellent sealer to area to be treated, thoroughly saturating CMU and avoiding excessive overlapping.
3. Cleaning:
    a. Clean all equipment with hot, soapy water.
    b. Clean all windows or surrounding areas accidentally oversprayed on same day of application using warm, soapy water.
    c. If feasible, to make cleaning easier, pretreat windows with soapy water just prior to sealer application and clean windows immediately after sealer application, while the sealer is still wet.
    d. If overspray is allowed to dry, clean surface with solvents such as mineral spirits or typical scraping methods.

3.03 FIELD QUALITY CONTROL

A. At least two weeks before starting above-grade masonry work, schedule a pre-installation conference at the jobsite in accordance with Section 01200 to discuss compliance with the requirements of the contract documents. Give two weeks advance notice to the participants,

including the contractor, mason contractor, flashing installer, CMU producer, and/or the manufacturer of the integral water-repellent CMU admixture and sealer. Advise the architect of the scheduled meeting date.

B. Inspection: Inspect the water repellent work with the Contractor, Architect, and applicator and compare with test panel results approved by the Architect. Determine if the substrates are suitably protected by the water repellents. After coating has dried, test surfaces with water spray and Material Absorption Tube test; reapply to any areas showing water absorption.

3.04 FINAL CLEANING

A. Clean site of all unused water repellents, residues, rinse water, wastes, and effluents in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and non-masonry surfaces, following completion of the work of this section.

C. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to water repellents.

END OF SECTION

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SECTION 07214

FOAMED-IN-PLACE MASONRY WALL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of insulation work is shown on drawings and indicated by provisions of this section.

B. Applications of insulation specified in this section include the following:
   1. Foamed-In-Place masonry insulation for thermal & sound values.

1.02 RELATED REQUIREMENTS

A. Section 04340 - Reinforced Unit Masonry Systems

1.03 SUBMITTALS

A. Product and technical presentation as provided by the manufacturer.
   1. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.
   2. Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.04 QUALITY ASSURANCE

A. Manufacturing Standards: Provide insulation produced by a single and approved manufacturer. The product must come from the manufacturer pre-mixed to ensure consistency.

B. Installer Qualifications for Foamed-In-Place Masonry Insulation: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than three years direct experience in the installation of the product used.

C. Warranty: Upon request, a one year product and installation warranty will be issued by both the manufacturer and installer.

D. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.
   1. Product must be classified by Underwriters Laboratory ® (“UL”) as to Surface Burning Characteristics
   2. Fire Resistance Ratings: ASTM E-119
   3. Surface Burning Characteristics: ASTM E-84
   4. Combustion Characteristics: ASTM E-136

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers of Foamed-In-Place Masonry Insulation: Subject to compliance with requirements, provide products from the following:
   1. "Core-Fill 500™"; Tailored Chemical Products, P.O. Drawer 4186, Hickory, N.C. 28603, (800) 627-1687
   2. Requests for substitutions will be considered in accordance with provisions of Section 01 630.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

B. Foamed-In-Place Masonry Insulation: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.

C. Fire-Resistance Ratings: Minimum four (4) hour fire resistance wall rating (ASTM E-119) for 8" and 12" concrete masonry units when used in standard two (2) hour rated CMUs.

D. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.
   1. Combustion Characteristics: Must be noncombustible, Class A building material.
   2. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177.
   3. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90).

E. Environmental Safety:
   Core-Fill 500™ complies easily with all relevant codes and standards (SBBCI, BOCA, ICBO, DOE, HUD, EPA, ASTM and others). Since it contains no polystyrenes, polyisocyanurates, polyurethane or petrochemicals, it is completely safe for the environment.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Application Assemblies:
   1. Block Walls: Exterior 8"concrete masonry units

3.02 INSTALLATION OF FOAMED-IN-PLACE INSULATION

A. General: Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.

1. Installation: Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

END OF SECTION

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SECTION 07220

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified Herein and Elsewhere
   1. Work under this Section includes:
      a. Board-type roof insulation.
      b. Cants and edge strips.
      c. Vapor barrier.
   2. Related work specified elsewhere:
      a. Rough Carpentry _ Section 06100

1.02 SUBMITTALS

A. Shop Drawings and Product Data
   1. Submit shop drawings and product data for the products of this and including the following:
      a. Layout drawings showing slopes, thicknesses and all details.

B. Certification
   1. Submit a letter certifying the following:
      a. The insulation is an acceptable base to the manufacturer of the roofing specified in Section 07500.
      b. All materials comply with the Specifications and are suitable to be a component of Factory Mutual Class I Construction.

PART 2 - PRODUCTS

2.01 MATERIALS

Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289

2.02 MANUFACTURERS

A. Atlas Roofing Corporation: www.atlasroofing.com.

B. Dow Chemical Co: www.dow.com.

C. GAF Materials Corporation: www.gaf.com.

D. Substitutions: See Section 01300 – Submittals.

2.03 ADHESIVE

A. The adhesive shall be as approved by the Manufacturer.

2.04 CANT/EDGE STRIP

A. Cant/Edge Strip shall be preformed fiberboard or treated wood compatible with the insulation material, and set in adhesive or mastic, except where shown on drawings as integral metal water dam cant fascia and scupper.

2.05 FASTENERS

A. Fasteners shall be approved by the Manufacturer for intended use.

PART 3 - PRODUCTS

3.01 INSPECTION OF COMPLETED SYSTEM

A. All work must be carefully inspected for construction damage and imperfections prior to the installation of the roofing. Any holes or tears must be patched with the appropriate material. The patch must extend at least 12 inches in all directions from the edges of the tear or puncture. Seal into position with appropriate adhesive.

3.02 CLEAN-UP

A. Keep premises free from accumulation of waste material and rubbish.

END OF SECTION

SECTION 07540

THERMOPLASTIC-POLYOLEFIN ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Adhered membrane roofing system.
2. Roof insulation.
3. Vapor retarder.

B. Related Sections include the following:

1. Division 06 Section Rough Carpentry for wood nailers, curbs, and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
3. Division 07 Section "Joint Sealants."

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 “Terminology Relating to Roofing and Waterproofing”; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute “Glossary of Roofing Terms” for definition of terms related to roofing work in this Section.

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Jobsite Safety: Execute all operations and provide a safe work environment in accordance to OSHA standards and regulations. This requirement applies to all contractor personnel, associated subcontractors, workers in other trades, and jobsite visitors.

1. Follow all industry fire prevention guidelines for storage of materials, staging areas, roof access, and application means and methods.
2. Any applicable local fire codes supersede industry guidelines.

D. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

1. Fire/Windstorm Classification: Class 1A- 90
2. Hail Resistance: MH

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Insulation fastening patterns.
4. Sheet layout with perimeter and corner defined.

C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of meeting performance requirements.

E. Qualification Data:

- For Installer; contractor with 5 years of experience on similar type projects
- For Manufacturer; Company with a Florida Product approved and tested systems equivalent to the product specified as a basis of design.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

G. Research/Evaluation Reports: For components of membrane roofing system.

H. Maintenance Data: For roofing system to include in maintenance manuals.

I. Warranties: Special warranties specified in Section 1.09

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Test Reports:

1. Roof drain and leader test or submit plumber’s verification.
2. Core cut (if requested).

E. Source Limitations: Obtain all components from single source roofing manufacturer.

F. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

G. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner, Engineer, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers

whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review Flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.09 guarantee

A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

1. Single-Source special warranty includes roofing membrane, Flashings, roofing membrane accessories, roof insulation, fasteners, cover board, vapor retarder, walkway products, manufacturer’s expansion joints, manufacturer’s edge metal products, and other single-source components of roofing system marketed by the manufacturer.

2. Warranty Period: 15 years from date of Substantial Completion.

B. Installer’s Guarantee: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, Flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Johns Manville Roofing Systems

2.02 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced. Product: JM TPO

1. Thickness: 60 mils (1.5 mm), nominal.

2.03 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard solvent based bonding adhesive for membrane, and solvent-based bonding adhesive for Flashings. Bonding adhesive and all adhesives to be asbestos free.

D. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

E. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors.

F. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, prepunched.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories

2.04 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Product: ENRGY 3 (as a basis of design)

1. Install no boards thicker than 1.5”. If insulation package required is thicker than 1.5”, install in multiple layers.

2.05 Tapered insulation

A. Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slope of [1/4 inch per 12 inches (1:48)] unless otherwise indicated.

2.06 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Retain below if insulation package requires mechanical fastening.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and provided by roofing system manufacturer.

D. Cold Fluid-Applied Adhesive: Manufacturer's No VOC, two-component cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSULATION INSTALLATION

A. Coordinate installing roof system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer’s instruction.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

F. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 1.5 inches (38 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer in a two-part cold fluid-applied adhesive.

J. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane specification ST6RA over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply water-based bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

    a. Remove and repair any unsatisfactory sections before proceeding with Work.

3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.05 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Engineer.

1. Notify Owner’s representative and Engineer 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Engineer and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Formed roof drainage sheet metal fabrications.
   2. Formed low-slope roof sheet metal fabrications.
   3. Formed wall sheet metal fabrications.
   4. Formed overhead-piping safety pans.

B. Related Sections:
   1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.

1.03 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
   1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.
   2. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.
   3. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft.: 208-lbf/sq. ft. perimeter uplift force, 312-lbf/sq. ft. corner uplift force, and 104-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, and keyed details. Distinguish between shop and field-assembled work. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of edge conditions, including eaves, crickets and counter-flashings as applicable.
   6. Details of special conditions.
   7. Details of connections to adjoining work.
   8. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim, Metal Closures, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
   3. Accessories and Miscellaneous Materials: Full-size Sample.

D. Qualification Data: For qualified fabricator.

E. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with County, Architect, County's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, and roof-mounted equipment.
   2. Review methods and procedures related to sheet metal flashing and trim.
   3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.

4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.07 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240, Type 304, dead-soft, fully annealed stainless-steel sheet of minimum uncoated thickness indicated; coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray pre-weathering.

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
2. Surface: Smooth, flat.
3. Exposed Coil-Coated Finish:
a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and

apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Color: Match manufactured roof panels, unless otherwise indicated on Drawings.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mils.

2.02 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.03 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, non-corrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.04 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal. Cleats and attachment device sizes shall be as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

F. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

G. Do not use graphite pencils to mark metal surfaces.

2.05 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 10-foot long, sections. Furnish with 6-inch wide, joint cover plates.
   1. Joint Style: Butt, with 12-inch wide, concealed backup plate.
      a. Prepainted, Metallic-Coated Steel: 0.02i7-thick.

B. Copings: Fabricate in minimum 96-inch long, but not exceeding 10-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
   1. Joint Style: Butt, with 12-inch wide, concealed backup plate.
      a. Prepainted, Metallic-Coated Steel: 0.0396-thick.

C. Base Flashing:
   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.0276 inch thick.

D. Counter-flashing and Flashing Receivers :
   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.0217 inch thick.

E. Roof-Penetration Flashing:
   1. Fabricate from the following materials:
      a. Lead: 4.0 lb/sq. ft., hard tempered.

F. Roof-Drain Flashing:
   1. Fabricate from the following materials:
      a. Lead: 4.0 lb/sq. ft., hard tempered.

2.06 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Overhead-Piping Safety Pans:
   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.03 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   5. Install sealant tape where indicated.
   6. Torch cutting of sheet metal flashing and trim is not permitted.
   7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder aluminum sheet.
2. Pre-tinning is not required for zinc-tin alloy-coated stainless steel.
3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.04 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where

possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
   1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
   2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.05 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.06 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.07 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.08 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07900

JOINT SEALANTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 REFERENCES

A. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.

B. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2010.

C. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

1.03 SUBMITTALS

A. See Section 01600 - Product Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years' experience.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.08 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Polyurethane Sealants:
   1. Bostik, Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals, Inc: www.chemrex.com.

B. Polysulfide Sealants:
   1. Pecora Corporation: www.pecora.com.
   2. BASF Construction Chemicals, Inc: www.chemrex.com.

C. Acrylic Sealants:
   1. Tremco, Inc: www.tremcosealants.com.

2.02 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Type 2 - General Purpose Exterior Sealant for joints in vertical and sloping surfaces; Polyurethane and Polysulfide; single component.
   1. Color: Standard colors matching finishing surfaces.

C. Type 1; self-leveling - General Purpose Exterior Sealant for joints on horizontal surfaces; Polyurethane and Polysulfide; single component.
   1. Color: Standard colors matching finished surfaces.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 25 to 50 percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C 1193.

C. Perform acoustical sealant application work in accordance with ASTM C 919.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

END OF SECTION

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SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere:

A. Work under this Section includes:

1. Glazed aluminum frames.
2. Aluminum doors and frames.
3. Related rough and finish hardware, except as otherwise noted.

B. Related work specified elsewhere includes:

1. Section 07900 – Joint Sealants

1.02 SUBMITTALS

A. Shop Drawings

Prior to fabrication and installation, submit shop drawings in compliance with Section 01300 for all items to be furnished under this Section. List all hardware proposed to be furnished.

1.03 ACCEPTABLE MANUFACTURERS

The products specified under this Section shall be the products of the following manufacturers, or equal, subject to compliance with specification requirements:

A. Cline Aluminum Doors, Inc. – Product 100BE

B. PPG Industries

C. Libby Owens Ford

PART 2 - PRODUCTS

2.01 GENERAL

Material shall conform to the manufacturer's standard specifications as approved by the

Engineer. Window and door units and systems shall be designed to withstand wind pressures at 20 psf with a maximum deflection not exceeding l/180 of respective spans.

2.02 EXTRUDED SHAPES

Extruded aluminum shall be 6063-T5 (ASTM B221) (GS 10A-T5) alloy and temper unless otherwise noted.

2.03 SHEET METAL

A. Sheet metal shall be tempered to the hardness consistent with the required forming operation. All sections shall be formed true to details and free from defects impairing appearance, strength and durability.

B. Unless otherwise indicated, non-exposed flashings shall be mill finish utility sheet .020 inches thick. Joints shall be lapped not less than 6 inches and sealed.

2.04 FASTENERS

Screws, bolts and fasteners shall be stainless steel.

2.05 FINISHES

All exposed aluminum surfaces and hardware shall be free of scratches and other serious surface blemishes and shall have a clear anodized finish.

2.06 BITUMINOUS PAINT

Bituminous paint shall be a coal tar coating conforming to Mil. Spec. MIL-C-18480A.

2.07 HARDWARE

A. Hardware for aluminum doors shall be in accordance with Section 087l0. All hardware must be approved by the Engineer prior to delivery or installation.

B. Hardware for aluminum doors shall be provided by the door manufacturer. Hardware must be approved by the Engineer prior to delivery or installation.

2.08 FABRICATION

A. Work shall be built by a manufacturer regularly engaged in production of aluminum doors and frames.

B. Fabricate and assemble doors and frames in as large sections in shop as consistent with shipping and field requirements.

C. All miters and joints shall form flush, hairline joints. All joints between sections and all field splices shall be strong enough to resist deformation and misalignment.

D. Fabricate and install with concealed fastenings where practicable.

E. Welds shall thoroughly penetrate the materials and produce a complete fusion of metal, following recommendations of AWS.

F. Install concealed reinforcement to be inconspicuous in finished surfaces.

G. Wire brushes used for shop or fieldwork shall be made of non-corrosive wire.

H. Protective Coating

Where aluminum comes into contact with materials which may cause staining or corrosion of the aluminum, separate the aluminum from the other material with a heavy coat of the specified bituminous paint, mastic caulking compound, or a non-absorptive tape or gasket.

I. Fixed Aluminum Framing

1. Glass framing members for installation of ¼" tempered glass shall provide for flush glazing on all sides, unless otherwise indicated, with through sight lines, and no projecting stops or face joints. The system shall provide fully resilient settings for glass by use of neoprene gaskets on both sides of the glass. Adapters and mountings for trim moldings and face materials shall be designed to permit the installation of these products in their regular manner, and shall not interfere with the normal assembly of the framing.

J. Flush Aluminum Door Composite Components: Minimum 5-ply composite laminated construction to include:

1. Facing: One-piece 0.040-inch smooth 5005-H14 stretcher-leveled aluminum alloy.
2. Substrate: One-piece glass-reinforced polypropylene backer.
3. Core: Organic materials shall be used to form a marine grade honeycomb core with high compression strength of 94.8 psi (ASTM C365), and internal aluminum hardware backup tube.
4. Hardware Backup: The hardware backup tube shall be a minimum of 4.25 inches in width, 1.375-inches in depth with a wall thickness of 0.125-inches Contiguous for the full perimeter of the door to allow for all specified and non-specified hardware reinforcement.
5. Hardware Prep: Basic to include mortise lock edge prep or cylindrical lock prep; and pairs prepped for flush bolts, if required.

6. Bonding Agent: Environmentally friendly adhesive with strength buildup of 350 pounds per square inch.
7. Perimeter Door Trim: Wall thickness of 0.050-inch minimum in 6063-T5 extruded aluminum alloy with special beveled edge cap design and integral weather stripping on lock stile.
8. Replaceable Door Trim: Mechanically fastened to the hardware backup tube, allowing for replacement in the field, if damaged.
9. Trim Finish: To have minimum of a Class I anodized finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all aluminum doors and frames level, square, plumb, at proper elevations, in alignment with other work, and in strict accordance with the manufacturer's recommendations. Maximum permitted deviation from true vertical or horizontal shall be 1/8 inch in 12 feet. Provide for expansion of 3/16 inch in 10 feet without causing buckling, opening of joints or undue stress on the fasteners.

B. All joints between metal frames and adjacent construction and between glass framing members shall receive sealant to provide a watertight installation.

C. All metal shall be securely and positively attached in place, using backing, masonry plugs, clips, anchors, screws, and bolts as required.

D. Where moldings are joined, they shall be accurately cut and fitted to result in a tightly closed joint.

E. After erection and glazing, check and readjust as required all items of operating hardware.

F. After erection, adequately protect all work from any damage during subsequent construction activities.

3.02 CLEANING

Metal surfaces of doors and frames shall be cleaned on both the inside and outside. Doors and frames shall be washed with a stiff fiber brush, soap and water, and thoroughly rinsed with clear water. Where aluminum has become stained, or discolored, it shall be cleaned or have the finish restored in accordance with recommendations of the Architectural Aluminum Manufacturer's Association. Stained, discolored or abraded materials that cannot be satisfactorily repaired shall be replaced with new materials at no additional cost to the County.

END OF SECTION

SECTION 08330

OVERHEAD COILING SERVICE DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling service doors.

1.02 RELATED SECTIONS

A. Section 08710 - Door Hardware: Product Requirements for cylinder core and keys.

B. Section 09900 - Painting: Field applied finish.

1.03 REFERENCES

A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NEMA MG 1 - Motors and Generators.

1.04 DESIGN / PERFORMANCE REQUIREMENTS

A. Overhead coiling service doors:
   1. Wind Loads: Design door assembly to withstand wind per structural calculations without damage to door or assembly components.
   2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years' experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.

2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weather tight location.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: sales@overheaddoor.com.

B. Wayne Dalton: www.wayne-dalton.com

C. Raynor/Duracoil Select: www.raynor.com

D. Requests for substitutions will be considered in accordance with provisions of Section 01300.

2.02 OVERHEAD COILING SERVICE DOORS

A. Heavy Duty Industrial Doors: Overhead Door Corporation, 620 Series Stormtite Service Doors as a basis for design.

1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
   a. Flat profile type F-265 for doors up to 18 feet 4 inches (5.59 m) wide, fabricated of:
      1) 18 gauge galvanized steel.
2. Finish:
   a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
      1) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
      2) Top Coat Color:
         (a) Powder coating finish in color as selected by Architect from manufacturer's standard colors.
   b. Stainless Steel: Slats and hood shall be stainless steel finished as follows.
      1) Finish: 2B mill finish.
3. Weatherseals:
   a. Vinyl bottom seal, exterior guide and internal hood seals.
   b. Interior guide weatherseal.
   c. Lintel weatherseal.
4. Bottom Bar:
   a. Two galvanized steel angles.
5. Guides: Guides weatherstripped with a vinyl weather seal at each jamb on the exterior curtain side.
   a. Three Structural steel angles with powder coated finish minimum thickness of 0.18 inch.
6. Brackets:
   a. Hot rolled prime painted steel to support counterbalance, curtain and hood.
   b. Galvanized steel to support counterbalance, curtain and hood.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8. Hood: Provide with internal hood baffle weatherseal.
   a. Stainless steel, 24 gauge hood with intermediate supports as required.
9. Electric Motor Operation: Provide UL listed electric operator, size as recommended by the manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
   a. Sensing Edge Protection:
      1) Electric sensing edge.
   b. Operator Controls:
      1) Push-button operated control station with open, close, and stop buttons.
      2) Controls for both interior and exterior location.
      3) Controls surface mounted.
   C. Motor Voltage: 115/230 single phase, 60 Hz.

10. Windload Design:
    a. Provide Miami-Dade County NOA.
    b. Provided FBC certification FL# .
11. Locking:
    a. Interior bottom bar slide bolt for manually operated doors.
12. Wall Mounting Condition:
    a. Face-of-wall mounting.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

G. Install perimeter trim and closures.

H. Instruct County's personnel in proper operating procedures and maintenance schedule.

3.04 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 08350
ACCESS HATCH DOORS

PART 1 - GENERAL

1.01 DESCRIPTION

Scope of Work: This Section includes providing all labor, materials and equipment necessary to install the access hatch doors on the waste holding tank as indicated on the Drawings and/or specified herein.

1.02 QUALITY ASSURANCE

A. Standards: The access doors shall meet the standards of the following:
   1. Standard Building Code
   2. OSHA Requirements

Manufacturers: Manufacturer shall be selected from one of the specified "Manufacturers" in the Orange County Utilities "List of Materials and Approved Manufacturers" as presented as an Appendix to these technical specifications.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Shop Drawings: Shop Drawings shall be submitted to the County for approval. Shop Drawings shall include manufacturer's data sheets showing all materials, connections and other required details to illustrate a complete operating access door. Refer to Division 1, Section 01300 "Submittals" for the specific requirements of the submittal.

1.04 WARRANTY AND GUARANTEES

A. The manufacturer shall provide lifetime guarantee for the access doors against defects in material and/or workmanship. Refer to Section 01740 "Warranties and Bonds" for requirements.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The access door for the waste holding tank shall have overall dimensions as shown on the Drawings.

B. The waste holding tank shall be furnished with an access frame and door(s). Equipment furnished shall include the necessary aluminum access frames, complete with hinged and slide bar equipped doors, stainless steel upper guide holder and level sensor cable holder. Doors shall be of aluminum diamond plate. The doors shall be sized according to pump manufacturer's recommendations. The access frame and door(s) shall have stainless steel hardware. The access doors size shall be a minimum of inside to inside wall dimensions with a HS-20 load rating. The support beam for loading rating shall be mounted on the door. Waste holding tank covers shall be permanently embossed "CONFINED SPACE" and painted lettering shall not be acceptable. Each door shall be equipped with a recessed hasp enclosure.

C. Access hatches shall have a non-removable back plate constructed of 1/4-inch floor plate, welded to the frame with holes sized to allow passage of pipe flanges with double modular pipe seal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The access hatches and doors shall be installed as recommended by the manufacturer and adjusted for proper operation without binding.

B. Edges of the aluminum frame that will be in contact with concrete shall be coated with coal tar epoxy prior to casting into the concrete, in accordance with Section 09900 "Painting."

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Commercial door hardware.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams.

1. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
2. Content: Include the following information:
   a. Identification number, location, hand, fire rating, and material of each door and frame.
   b. Type, style, function, size, quantity, and finish of each door
   c. Complete designations of every item required for each door or opening including name and manufacturer.
3. Keying Schedule: Prepared by or under the supervision of Installer, detailing County's final keying instructions for locks.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer. Installer's responsibilities include supplying and installing door hardware and being available during the course of the Work to consult with Contractor, Architect, and County about door hardware and keying.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

C. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.

1.04 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Warranty Period: 3 years from date of Substantial Completion, except as follows:

1. Exit Devices: 5 years from date of Substantial Completion.
2. Manual Closers: 10 years from date of Substantial Completion.

PARTS 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section. Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products and products complying with BHMA standard referenced.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation listed for some door hardware types required are for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.02 HINGES

A. Butts and Hinges: BHMA A156.1.

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units. Template Hinge Dimensions: BHMA A156.7.

C. Hinge Base Metal/Types: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin
2. Interior Hinges – Metal Doors: Stainless Steel, with stainless-steel pin

D. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.

E. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes. Coordinate with requirements for Fire Rated doors.
2. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors; wood screws for wood doors. Finish screw heads to match surface of hinges.

2.03 LOCKS AND LATCHES

A. Mortise Locks: BHMA A156.13, Series 1000, stamped steel case with steel or brass parts.

B. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

C. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Lock Trim: Levers. Lever handles for doors that will be accessible to handicapped persons or blind persons and which lead to dangerous areas shall be knurled or abrasive coated.

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.

F. Backset: 2-3/4 inches, unless otherwise indicated.

G. Strikes: Manufacturer's standard strike with strike box for each latch bolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

H. Basis-of-Design Manufacturer/Product: 8200 Series Mortise Locks with LNL lever handles by Sargent are listed in Part 3 Schedule.

Use only – Corbin-Russwin ML 2000 Series, Yale 8800FL Series

2.04 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks: BHMA A156.5, Grade 1.

2.05 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors.

B. Dustproof Strikes: BHMA A156.16, Grade 1.

C. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.

2.06 EXIT DEVICES

Exit Devices: BHMA A156.3, Grade 1.

A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

B. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Panic Exit Devices: Listed by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection.

D. Outside Trim: Lever with cylinder; material and finish to match locksets. Match design for locksets and latch sets.

E. Basis-of-Design Manufacturer/Product: Series 80 by Sargent; particular model requirements are listed in the Part 3 Schedule. Subject to compliance with requirements specified, provide either the named product or a comparable product by another manufacturer.

F. Approved Equals – Corbin-Russwin ED 5000 Series, Yale 7000 Series

2.07 LOCK CYLINDERS

A. Standard Lock Cylinders: Schlage Primus Level 3 (County Standard)

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: as required

C. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 3 construction master keys.
2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 3 construction master keys.
3. After Substantial Completion and prior to Final Completion, replace construction cores with permanent cores.

D. Manufacturer: Same manufacturer as for locks and latches.

2.08 KEYING

Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master key system.

Keys: Nickel silver. In addition to one extra key blank for each lock, provide three cylinder change keys. Key to match county standard.

2.09 OPERATING TRIM

A. Standard: BHMA A156.6.

1. Offset Pull: J402 x 630.
2. Push Plate: J301 x B4E x 630.
3. Push/Pull Bars: Mega Tek by Rockwood/Assa Abloy.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

2.10 CLOSERS

A. Accessibility Requirements: Comply with the following maximum opening-force requirements:

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

E. Coordinators: BHMA A156.3.

F. Basis-of-Design Manufacturer/Product: 351 series by Sargent/Assa Abloy; particular model requirements are listed in the Part 3 Schedule. Subject to compliance with requirements specified, provide either the named product or a comparable product by another manufacturer.

G. Approved Equals – Corbin Russwin DC 8200 Series, Yale 4400 Series, Norton 7500 Series

2.11 PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from : 0.050-inch thick stainless steel.

1. Kick Plates: J102 x B3E x 630.

B. Size: 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side.

1. Kick Plate Height: 10 inches.

2.12 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1. Provide wall bumper type stops.

B. Mechanical Door Holders: BHMA A156.16, Grade 1.

C. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.

D. Silencers for Door Frames: BHMA A156.16, Grade 1; neoprene or rubber; fabricated for drilled-in application to frame.

2.13 DOOR GASKETING

A. Standard: BHMA A156.22. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

C. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

2.14 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.

2.15 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.

C. Finishes: BHMA A156.18, as indicated in door hardware sets.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.

B. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit.

1. Replace units that cannot be adjusted to operate as intended.
2. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

F. Key Lock Box: Locate on exterior wall as indicated; contact local fire marshal jurisdiction to verify location before installation.

G. DOOR HARDWARE SETS

H. The following schedule indicates general requirements for hardware required; do not consider it as entirely inclusive; provide all items required for a fully operating door. Should any particular door or item be omitted in any scheduled hardware group, provide door or item with hardware same as required for similar purposes. Quantities listed are for each pair of doors, or for each single door.

HW-1 – Door 101

3 ea.	Hinges	TA2314 4 ½" x 4 ½" NRP	US32D	MCK
1 ea.	Exit Device	8813 x ETL (L/Cyl)	US32D	SGT
1 ea.	Cylinder	Schlage Primus Level 3	US26D	SCH
1 ea.	Closer	351 H	EN	SGT
1 ea.	Kick Plate	K1050 10" x 2" LWOD	US32D	ROC
1 set	Weather Stripping	S88D x LAR		PEM
1 ea.	Rain Drip	346C -4" greater than width		PEM
1 ea.	Threshold	2005AV x ES/MS x LAR		PEM

HW-2 – Door 101A

3 ea.	Hinges	TA2314 (4 ½" X 4 ½")	US32D	MCK
1 ea.	Exit Device	8815 X ETL	US32D	SGT
1 ea.	Closer	351 P10	EN	SGT
1 ea.	Kick Plate	K1050 10" x 2" LWOD	US32D	ROC
1 ea.	Wall Bumper	426	US26D	ROC
1 ea.	Perimeter Gasket	S88D x LAR		PEM

HW-3 – Door 102

6 ea.	Hinges	TA2314 4 ½" x 4 ½" NRP	US32D	MCK
1 ea.	Lockset	8251 x LNL (L/Cyl)	US32D	SGT
1 ea.	Cylinder	Schlage Primus Level 3	US26D	SCH
2 ea.	Flushbolts	556WS	US26D	ROC
1 ea.	Closer	351 H	EN	SGT
1 ea.	Overhead Holder	#9- 326	630	RIX
1 ea.	Astragal	By Door Supplier		
1 set	Weather Stripping	S88D x LAR		PEM
1 ea.	Rain Drip	346C -4" greater than width		PEM
1 ea.	Threshold	2005AV x ES/MS x LAR		PEM

HW-4 – Door 103,100A

3 ea.	Hinges	TA2314 4 ½" x 4 ½" NRP	US32D	MCK
1 ea.	Lockset	8251 x LNL (L/Cyl)	US32D	SGT
1 ea.	Cylinder	Schlage Primus Level 3	US26D	SCH
1 ea.	Closer	351 PS	EN	SGT
1 ea.	Kick Plate	K1050 10" x 2" LWOD	US32D	ROC
1 set	Weather Stripping	S88D x LAR		PEM
1 ea.	Rain Drip	346C -4" greater than width		PEM
1 ea.	Threshold	2005AV x ES/MS x LAR		PEM

HW-5 – Door 100B

3 ea.	Hinges	TA2314 4 ½" x 4 ½"	US32D	MCK
1 ea.	Passage	8215 x LNL	US32D	SGT
1 ea.	Closer	351 PS	EN	SGT
1 ea.	Kick Plate	K1050 10" x 2" LWOD	US32D	ROC
3 ea.	Silencers	608		ROC

HW-6 – Door 103A

1 ea.	Cylinder	Schlage Primus Level 3	US26D	SCH

HW-7– Door 104

3 ea.	Hinges	TA2314 4 ½" x 4 ½"	US32D	MCK
1 ea.	Privacy			
1 ea.	Closer	351 PS	EN	SGT
1 ea.	Kick Plate	K1050 10" x 2" LWOD	US32D	ROC
3 ea.	Silencers	608		ROC

END OF SECTION

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SECTION 08900

LOUVERS & VENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Formed aluminum stationary acoustical louvers.

1.02 RELATED SECTIONS

A. Section 04340 – Reinforced Unit Masonry

B. Section 06100 – Rough Carpentry

C. Section 07620 – Sheet Metal Flashing

D. Section 07900 – Joint Sealants

E. Section 09900 – Painting

1.03 REFERENCES

A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AAMA 2605 – High Performance Organic Coatings on Architectural Extrusions and Panels.

C. AMCA 500-L – Test Methods for Louvers.

D. AMCA 511 – Certified Ratings Program for Air Control Devices.

E. ASCE 7 – Minimum Design Loads for Buildings and Other Structures

F. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B221 – Standard Specifications for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposure of Paint and Related Coatings.

I. ASTM D4214 – Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films.

J. ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

K. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.

L. ASTM E90 – Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

1.04 SUBMITTALS

A. Product Data: For each product to be used, including:
   1. Manufacturer's product data including performance data.
   2. Installation Instructions
   3. Maintenance and Operations Manuals

B. Shop Drawings
   1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

C. Samples
   1. Submit color chip sample for units with factory-applied paint.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.

B. Production Qualifications:
   1. Louvers shall be licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

   2. Louvers shall be Florida Product Approved.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Manufacturer shall provide a standard limited warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the County of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the County.

B. Manufacturer shall provide 20 year limited warranty for fluoropolymer-based finish on aluminum substrates.
   1. Finish Coating shall not peel, blister, chip, crack, or check.
   2. Chalking, fading, or erosion of finish when measured by the following tests:
      a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
      b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822
      c. Finish coating shall not erode at a rate in excess of .01 mils/year confirmed by Florida test samples.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation P.O. Box 410 Schofield, WI 54476. 715-359-6171.
B. Or Approved Equal per Section 01300.

2.02 FORMED ALUMINUM ACOUSTICAL LOUVERS

A. Fabrication:
   1. Model: 635D or as noted on Mechanical Drawings
      Frame:
      a. Frame Depth: 6 inches
      b. Material: Extruded aluminum
      c. Wall Thickness: 0.081 inch
   2. Blades:
      a. Style: Acoustical
      b. Material: Extruded aluminum
      c. Wall Thickness: 0.081 inch
      d. Insulation: 6-lb density rockwool
      e. Angle: 37.5 degrees
      d. Centers: 8.5 inches (215.9 mm), nominal

B. Performance Data:
   1. Free Area: 59% (9.41 sq.ft.)
   2. Water Penetration: Maximum of .01 ounces at an air flow of 949.4 FPM
   3. Static Pressure Loss: Not more than .15 inch of water gauge at an air flow of 1214 FPM free area velocity.
   4. Sound Data: Tested in accordance with ASTM E90.

Selected 1/3 Octave Bands Center Frequency HZ	**125**	**250**	**500**	**1000**	**2000**	**4000**
Transmission Loss in Decibels	6	6	10	14	17	12
Free Field Noise	12	12	16	20	23	18

2.03 LOUVER ACCESSORIES

A. Extended Aluminum Sill: Provide sill flashing of same material and finish as louvers where indicated on the drawings.

B. Louver Screens: Provide framed removable, re-wire-able screens for exterior louvers.
   1. Bird Screen:
      a. Aluminum: Aluminum, ½ inch by 0.063 inch (12.7 mm by 1.6 mm), expanded, flattened.

2. Insect Screen:
   a. 20 x 20 fiberglass mesh (charcoal color) in an aluminum removable frame.

2.04 FABRICATION

A. Fabrication Requirements:
   1. Performance: Fabricate as required for optimum performance with respect to water penetration, strength, durability, and appearance.
   2. Size: Fabricate louvers in walls to meet dimensions indicated on Contract Documents.
   3. Field Measurement: Verify size, location, and placement of louvers before fabrication.
   4. Shop Assembly:
      a. Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.
      b. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.
      c. Clearly mark units for reassemble and coordinated installation.
   5. Accessories: Include supports, anchorages and accessories required for complete assembly.
   6. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.
   7. Horizontal Mullions: Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.
   8. Connections: Join frame and blade members to one another by welding, except where field bolted connections between frame members are made necessary by size of louvers.
   9. Spacing: Maintain equal blade spacing to produce uniform appearance.

2.05 FINISHES (FACTORY)

A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide color as indicated or, if not otherwise indicated, as selected by architect.

B. Standard mill finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean opening thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install louvers at locations as indicated on the drawings and in accordance with the manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. Install joint sealants as specified in Section 07900.

3.04 CLEANING

A. Clean louver surface in accordance with manufacturer's instructions.

B. Touch-up paint, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Painting of plaster, wood, metal, masonry, and other surfaces designated to be painted except factory-applied finishes.

1.02 RELATED SECTIONS

Section 07900 - Joint Sealant

1.03 REFERENCES

A. American Water Works Association, Inc. (AWWA) latest edition:
AWWA D100 - Welded Steel Tanks For Water Storage
AWWA D102 - Coating Steel Water Storage Tanks

B. Steel Structures Painting Council (SSPC) latest edition Specifications:

C. OSHA
1. 1926 Subpart C – General Safety and Health Provisions
2. 1926 Subpart D – Occupational Health and Environmental Controls
3. 1926 Subpart E – Personal Protective and Life Saving Equipment
4. 1926 Subpart F – Fire Protection and Prevention
5. 1926 Subpart H – Material Handling, Storage, Use, and Disposal
6. 1926 Subpart Z – Toxic and Hazardous Substances

1.04 DEFINITIONS

Coating = emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, whether used as prime, intermediate, or finish coats.

DFT = abbreviation for Dry Film Thickness.

1.05 SYSTEM DESCRIPTION

A. Schedule of coating colors will be provided by the E/A after award. The Contractor shall base his bid on ceilings of a color different than walls and an average of two wall colors per room or area. Colors other than those shown in the manufacturer's standard color charts may be required for building finishes. Strong colors may be selected for doors, piping, equipment, and miscellaneous features. Exterior building or structure colors will be limited to two plus trim.

1.06 SUBMITTALS

A. Within 30 days after award of the Contract, the Contractor shall notify the E/A, in writing, the name of the paint manufacturer for the Project.

B. Prior to submitting shop drawings for any item requiring shop or field applied primer or finish coatings, submit to the E/A a Painting Schedule, indicating major items to be painted, preparation, paint manufacturer, product designation, and dry mill thickness. This submittal shall include the manufacturer's written recommendation of the type paint for each item to be painted.

C. Upon request submit three 8-1/2 inch x 11-inch samples of requested colors for approval by the E/A.

1.07 QUALITY ASSURANCE

A. Unless otherwise specified, all work and materials for the preparation and coating of all metal surfaces shall conform to the applicable requirements specified in the Steel Structures Painting Manual, Volume 2, Systems and Specifications Revised, latest edition, published by the Steel Structures Painting Council.

B. It is the intent of this Specification that the Contractor use one paint manufacturer throughout, unless otherwise approved by the E/A. Products shall be manufactured by one of the following, or equal:

1. Tnemec - Tnemec Co., Inc., North Kansas City, Missouri.
2. Porter - Porter Paint Company, Louisville, Kentucky.
3. Glidden-Glidden Coatings and Resins, Cleveland, Ohio.
4. Induron-Induron Coatings Inc., Birmingham, Alabama

C. Manufacturers other than the above shall submit product data for all products specified in this Section to the E/A for approval. No request for substitution will be considered which decreases the dry film thickness and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Bidders desiring to use paints other than those specified shall submit their proposal based on the specified materials, together with the information noted above, and indicate the sum which will be added to or deducted from the base bid, should the alternate materials be acceptable.

1.08 PAINTING CONFERENCE

A. At the request of the County, the Contractor shall schedule a conference of the painter, County, a technical representative of the paint supplier, and the E/A to discuss painting requirements and finalize color selections before painting is started.

B. Prior to painting any surface the Contractor shall schedule a meeting with the painter and an County representative to inspect the surface preparation and verify that the surface is ready for painting. Failure to inspect a surface prior to coating could result in the rejection of the coating.

1.09 SAMPLES

A. Paint colors will be selected by the Owner with final approval by the County. Compliance with all other requirements is the exclusive responsibility of the Contractor.

B. Samples of each finish and color shall be submitted to the Engineer for approval before any work is started.

C. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats, For example, where three coat work is special, the sample shall be divided into three areas: one showing application of one coat only, one showing the application of two coats, and the third showing the application of three coats.

D. Such samples when approved in writing shall constitute a standard, as to color and finish only, of acceptance or rejection of the finish work.

E. For piping, valves, equipment, and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish and the general characteristics.

F. Rejected samples shall be resubmitted until approved.

G. Before proceeding with room painting, the Contractor shall finish paint one complete room. After approval, this sample room shall serve as a standard for texture and workmanship throughout the project.

1.10 DELIVERY AND STORAGE

A. All materials shall be delivered to the job in original sealed and labeled containers of the paint manufacturer, and shall be subject to inspection by the E/A. Labels shall show name of manufacturer, type of coating, formulation, color and instructions for reducing.

B. Storage areas outside of the structures being constructed will be submitted by the Contractor for the E/A to review for the storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. The Contractor shall take all safety precautions in accordance with Section 7 of AWWA D102, NFPA Bulletin No. 101 and all federal, state and local regulations. Proper containers outside of the buildings/structures shall be provided and used by the Contractor for painting wastes.

C. Exercise every precaution in the storing of paints, solvents, cleaning fluids, rags, and similar materials as to eliminate the risk of spontaneous combustion or other hazardous conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials used in the work except oils, thinners and driers, shall be of the brands and qualities specified.

B. All cleaners, thinners, driers and other additives and surface pretreatment materials shall only be those approved for use by the manufacturer of the coatings.

C. Do not dilute paints except as recommended by the paint manufacturer.

D. Paint containing lead or chromate is not allowed.

E. Protective coatings for surfaces which will be in contact with potable water shall be listed by NSF International as approved for potable water contact in accordance with ANSI/NSF Std. 61, Section 5 Protective (Barrier) Materials.

F. Emulsion and alkyd paint shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.

2.02 PAINT SYSTEMS GUIDE

The following table illustrates the general features of the standard coating systems and is provided as a general guideline, and may be superseded by specific coating requirements outlined within this specification or on the Drawings:

System No.	Generic Type	Surface Material	Finish	Typical Function
1	Epoxy / Polyurethane	Ferrous Metal, Non-galvanized	Gloss	Exterior metals not subject to immersion or frequent splashing
2	Polyurethane	Ferrous Metal, galvanized	Gloss	Exterior metals not subject to immersion or frequent splashing
3	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Interior metals not subject to immersion or frequent splashing or condensation
4	Alkyd	Ferrous Metal, galvanized	Semi-gloss	Interior metals not subject to immersion or frequent splashing or condensation
5	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Interior metals subject to condensation

System No.	Generic Type	Surface Material	Finish	Typical Function
6	Epoxy	Ferrous Metal, galvanized	Semi-gloss	Interior metals subject to condensation
7	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Metals subject to immersion or frequent splashing
8	Epoxy	Ferrous Metal, galvanized	Semi-gloss	Metals subject to immersion or frequent splashing
9	Epoxy	Concrete	Semi-gloss	Interior
10	Epoxy	Concrete	Tile-like gloss	Interior walls of washrooms
11	Acrylic	Concrete	Low sheen	Precast concrete ceilings, beams, columns
12	Elastomeric	Concrete	Low sheen	Exterior concrete
13	Epoxy	Masonry	Semi-gloss	Interior masonry
14	Epoxy	Masonry	Tile-like gloss	Interior walls of washrooms
15	Elastomeric	Masonry	Low sheen	Exterior masonry
16	Acrylic	Masonry	Low sheen	Interior masonry
17	Acrylic	Drywall, plaster	Low sheen	Interior drywall, plaster
18	Acrylic	Plaster, stucco	Low sheen	Exterior plaster, stucco
19	Alkyd	Wood	Gloss	Exterior wood
20	Alkyd	Wood	Semi-gloss	Exterior wood
21	Alkyd	Wood	Gloss	Interior wood
22	Alkyd	Wood	Semi-gloss	Interior wood
23	Acrylic	Wood	Low sheen	Interior wood
24	Acrylic	Canvas wrapped insulation	Semi-gloss	Canvas wrapped insulated piping
25	Coal Tar Epoxy	Ferrous Metal	Semi-gloss	Metals submerged in non-potable water
26	Coal Tar Epoxy	Concrete	Semi-gloss	Concrete in non-potable water or below grade
27	Epoxy	Ferrous Metal	Semi-gloss	Metals submerged in potable water
28	Epoxy	Concrete	Semi-gloss	Concrete submerged in potable water

System No.	Generic Type	Surface Material	Finish	Typical Function
29	Sealer, Hardener	Concrete	Semi-gloss	Concrete Floors

2.03 COATING SYSTEMS

A. System No. 1

1. System No. 1 shall be used for exterior non-galvanized ferrous metals that are not subject to immersion or frequent splashing of water or wastewater, including but not limited to the following:
   a. Exposed exterior piping, valves and fittings.
   B. b. Exterior mechanical equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.
2. System No. 1 surface preparation shall be SP 6.
3. System No. 1 shop primer shall be one coat of one of the following, or equal:
   a. Induron P-14 Armorguard Primer at 3.0 - 5.0 mils DFT
   b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT.
   c. Glidden 5205 Glid-Guard Tank and Structural Primer at 2.0 mils DFT
4. System No. 1 field touch-up shall be the same material as Shop Primer.
5. System No. 1 intermediate coats shall be two (2) coats of one of the following, or equal:
   a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT
   b. Tnemec Series N69 @ 4.0-6.0 mils DFT
   c. Glidden Life Master Pro High Performance Acrylic No.6900 at 1.5 mils DFT
6. System No. 1 finish shall be one full coat of High Gloss aliphatic polyurethane, of one of the following, or equal:
   a. Induron Indurethane 5500 Gloss Enamel at 1.5 to 2.5 mils DFT
   b. Tnemec Series 72 Endra-Shield (gloss) @ 2.5-4.0 mils DFT
   c. Glidden Life Master Pro High Performance Acrylic No. 6900 Series at 1.5 mils dry coat.

B. System No. 2

1. System No. 2 shall be used for exterior galvanized ferrous metals which are not subject to immersion or frequent splashing of water or wastewater, including but not limited to the following:
   a. Exposed galvanized piping and fittings.
   b. Exposed galvanized conduit, equipment, miscellaneous metal, etc. without a factory-applied final finish.
2. System No. 2 surface preparation shall be SSPC-SP1 Followed by Hand or Power Tool Cleaning to scarify.
3. System No. 2 primer shall be one coat of one of the following, or equal:
   a. Tnemec Series N69 @ 3.0-5.0 mils DFT

4. System No. 2 finish shall be two 1 coat of one of the following or equal:
    a. Induron Indurethane 5500 Gloss Enamel at 1.5 to 2.5 mils DFT per coat
    b. Tnemec Series 72 Endrua-Shield @ 2.0-3.0 mils DFT .
    c. Porter I.A.-24 Gloss Finish at 1.5 mils DFT per coat.
    d. Glidden 4550 Series Glid-Guard Alkyd Industrial Enamel at 2.0 mils DFT per coat.

C. System No. 3
1. System No. 3 shall be used for interior, non-galvanized, ferrous metals not subject to immersion, frequent splashing or condensation, including but not limited to the following:
    a. Interior piping, valves and fittings, except piping subject to condensation.
    b. Exposed structural steel.
    c. Steel stairs and railings.
    d. Interior cranes and hoists.
    e. Steel doors and frames.
    f. Interior equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.
2. System No. 3 surface preparation shall be SSPC-SP6 Commercial Blast Cleaning.
3. System No. 3 shop primer shall be one coat of one of the following, or equal:
    a. Induron P-14 Armorguard Primer at 3.0 to 5.0 mils DFT
    b. Tnemec Series 1 Omni-Thane @ 2.5-3.5 mils DFT
    c. Porter U-Prime Universal Primer at 2.0 mils DFT.
    d. Glidden 5210 Glid-Guard Tank & Structural Primer 5205/5206/5207 at 2.0 mil DFT.
4. System No. 3 field touch-up shall be the same material as the shop primer.
5. System No. 3 finish shall be two (2) coats of one of the following, or equal:
    a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat
    b. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.
    c. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.
    d. Glidden Ultra Hide Alkyd Semi-Gloss Enamel No. UH8000 at 1.5 mils DFT per coat.

D. System No. 4
1. System No. 4 shall be used for interior, galvanized, ferrous metals not subject to immersion, frequent splashing or condensation, including but not limited to the following:
    a. Interior galvanized piping, except piping subject to condensation.
    b. Interior galvanized conduit, mechanical equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.
    c. Metal decking
2. System No. 4 surface preparation shall be SSPC-SP:1

3. System No. 4 primer shall be one coat of one of the following, or equal:
    a. Induron Vinyl Wash Primer at 0.5 to 1.0 mils DFT
    b. Tnemec Series 115 Uni-Bond DF @ 2.0-4.0 mils DFT
    c. Porter 1799 V.C.-17 Wash Prime at 0.5 mil DFT.
    d. Glidden Glid-Guard Tank and Structural Primer no. 5205/5206/5207 at 2.0 mils DFT.
4. System No. 4 finish coat shall be two (2) coats of one of the following, or equal:
    a. Induron Indurethane 5500 Gloss Enamel at 1.5 to 2.5 mils DFT per coat.
    b. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.
    c. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.
    d. Glidden Ultra Hyde Alkyd Semi-Gloss Enamel UH8000 at 1.5 mils DFT per coat.

E. System No. 5
1. System No. 5 shall be used for interior, non-galvanized ferrous metals subject to condensation, including but not limited to the following:
    a. Interior liquid process and water piping.
    b. Chemical piping.
    c. Air intake piping.
2. System No. 5 surface preparation shall be SSPC-SP6 Commercial Blast Cleaning
3. System No. 5 shop primer shall be one coat of one of the following, or equal:
    a. Induron P-14 Armorguard Primer at 3.0 to 5.0 mils DFT
    b. Tnemec 37-77 Chem-Prime Universal Primer at 2.0 mils DFT.Series 1 Omnithane @ 2.5-3.5 mils DFT.
    c. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.
    d. Glidden 5251/5252 Glid-Guard Epoxy Chromate Metal Primer at 1.5 mils DFT.
4. System No. 5 field touch-up shall be the same material as the shop primer.
5. System No. 5 finish shall be two (2) coats of one of the following, or equal:
    a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.
    b. Tnemec Series N69 Epoxoline II @ 3.0-5.0 mils DFT per coat.
    c. Porter M.C.R.-43 High Build Semi-Gloss Epoxy at 3.0 mils DFT per coat.
    d. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish at 3.0 mils DFT per coat.

F. System No. 6
1. System No. 6 shall be used for interior, galvanized, ferrous metals subject to condensation, including but not limited to interior galvanized liquid process and water piping.
2. System No. 6 surface preparation shall be SP M1 or SP 7.
3. System No. 6 primer shall be one coat of one of the following, or equal:

a. Induron Vinyl Wash Primer 0.5 to 1.0 mils DFT
b. Tnemec: Series N69 @ 2.5-3.5 mils DFT
c. Porter 45 Galvaprep at 1000 square feet per gallon.
d. Glidden 5251/5252 Glid-Guard Epoxy Chromate Metal Primer at 1.5 mils DFT.

4. System No. 6 finish shall be two (1) coat of one of the following, or equal:
   a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.
   b. Tnemec Series N69 @ 2.5-3.5 mils DFT (Maximum DFT for galvanized steel *should be 7.0 mils.*
   c. Porter M.C.R.-43 High Build Semi-Gloss Epoxy at 3.0 mils DFT per coat.
   d. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish at 3.0 mils DFT per coat.

G. System No. 7
1. System No. 7 shall be used for non-galvanized, ferrous metals subject to immersion or frequent splashing, including but not limited to the following:
   a. Submerged piping and piping subject to splashing.
   b. Submersible pumps.
   c. Submerged miscellaneous metal, equipment, etc. without a factory-applied final finish.
2. System No. 7 surface preparation shall be SSPC-SP10.
3. System No. 7 shop primer shall be one coat of one of the following, or equal:
   a. Induron P-14 Armorguard Primer at 3.0 to 5.0 mils DFT.
   b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT
   c. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.
   d. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy No. 5465 Series at 3.0 mils DFT.
4. Field touch-up shall be the same material as shop primer.
5. Finish shall be two (2) coats of one of the following, or equal:
   a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.
   b. Tnemec Series 446 Perma-Thane @ 5.0-7.0
   c. Porter 24770/24771 Tank Lining at 3.0 mils DFT per coat.
   d. Glidden Glid-Guard Chemical Resistant Epoxy No. 5250/5242 at 5.0 mils DFT per coat.

H. System No. 8
1. System No. 8 shall be used for galvanized, ferrous metals subject to immersion or frequent splashing, including but not limited to the following:
   a. Submerged galvanized piping and piping subject to splashing.
   b. Submerged galvanized conduit, miscellaneous metal, equipment, etc. without a factory-applied final finish.
2. System No. 8 surface preparation shall be SP M1 and SP 7.
3. System No. 8 primer shall be one coat of one of the following, or equal:
   a. Tnemec: Series N69 @ 2.5-3.5 mils DFT
   b. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.

c. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy Resistant No. 5465 Series at 5.0 mils DFT.

4. System No. 8 finish shall be two (2) coats of one of the following, or equal:
   a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.
   b. Tnemec Series N69 @ 2.5-3.5 mils DFT
   c. Porter 24770/24771 Tank Lining System at 3.0 mils DFT per coat.
   d. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish (Double Build) at 5.0 mils DFT per coat.

I. System No. 9

1. System No. 9 shall be used for interior, exterior, , except concrete requiring a tile-like epoxy finish, including but not limited to the following:
   a. Interior cast-in-place concrete walls, except washroom walls.
   b. Pipe gallery walls and ceiling.
2. System No. 9 surface preparation shall be SP C2 or SP C3 (horizontal surfaces only).
3. System No. 9 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish. Delete filler for all submerged concrete):
   a. Tnemec 54-561 Modified Epoxy Masonry Filler at 80 square feet per gallon.
   b. Porter 895 Unifill at 100 square feet per gallon.
   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
   d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.
4. System No. 9 finish shall be two (2) coats of one of the following, or equal:
   a. Tnemec Series 66 Epoxoline at 5.0 mils DFT per coat.
   b. Porter 24770/24771 Tank Lining System at 3.0 mils DFT per coat.
   c. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish (Double Build) at 5.0 mils DFT per coat.
   d. Induron Armorguard SG Epoxy at 3.0 to 5.0 mils DFT per coat.

System 9A: Submerged Concrete in Wastewater or Concrete Exposed to Wastewater Splash or Wastewater Fumes (**moderate environment**).

System 9A Surface Preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 MortarClad at an average of 1/16". Fill deep voids (greater than 3/8" and up to 4") with Tnemec Series 217 MortarCrete

System 9A Finish System:

1st Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT

2nd Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT

System 9B: Submerged Concrete in Wastewater or Concrete Exposed to Wastewater Splash or Wastewater Fumes (**severe environment** such as

headworks, digesters, influent structures, grit chambers, lift stations, etc).

System 9B Surface Preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 at an average of 1/16". Fill deep voids (greater than 3/8" and up to 4") with Tnemec Series 217 MortarCrete.

System 9B Finish System:

1st Coat: Tnemec Series 434 Perma-Shield @ 1/8"

2nd Coat: Tnemec Series 435 Perma-Glaze @ 18.0-20.0 mils DFT

J. System No. 10

1. System No. 10 shall be used for interior concrete and CMU requiring a tile-like epoxy finish, including but not limited to interior washroom walls.
2. System No. 10 surface preparation: Allow new Concrete to cure for 28 days. All surfaces must be clean and dry.
3. System No. 10 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish):
   a. Tnemec Series 1254 Epoxoblock WB @ 100-125 SF / GL (CMU Only)
   b. Porter 895 Unifill at 100 square feet per gallon.
   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
   d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.
4. System No. 10 finish shall be two (2) coats of one of the following, or equal:
   a. Tnemec Series 84 Ceramlon ENV at 4.0-6.0 mils DFT per coat.
   b. Porter: First coat, Porter M.C.R.-43 High Build Epoxy at 5.0 mils DFT. Second coat, Porter M.C.R.-43 Gloss Epoxy at 2.0 mils DFT.
   c. Glidden 5550 Series Glid-Guard Glid-Tile Epoxide Coating at 6.0 mils DFT per coat.
   d. Induron Perma-Clean II at 4.0 to 6.0 mils DFT per coat.

K. System No. 11

1. System No. 11 shall be used for interior concrete and Concrete Masonry requiring a matte finish, including but not limited to precast concrete ceilings, CMU walls, beams and columns.
2. System No. 11 surface preparation shall be SP C2.
3. System No. 11 filler shall be one coat of one of the following, or equal:
   a. Tnemec Series 1254 Epoxoblock WB @ 100-125 SF / GL square feet per gallon.
   b. Porter 895 Unifill at 100 square feet per gallon.
   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
   d. Induron AC 202 Acrylic Block Filler at 75 sq. ft. per gallon.
4. System No. 11 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.
b. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.
c. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.
d. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.

L. System No. 12
1. System No. 12 shall be used for exterior concrete and CMU requiring a matte finish.
2. System No. 12 surface preparation shall be SP C2.
3. System No. 12 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish):
   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon.
   b. Porter 895 Unifill at 100 square feet per gallon.
   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
   d. Induron primer not needed
4. System No. 12 finish shall be two (2) coats of one of the following, or equal:
   a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.
   b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.
   c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.
   d. Induron AC 403 Acrylic Elastomeric at 6.0 mils DFT per coat.

M. System No. 13
1. System No. 13 shall be used for interior masonry, including but not limited to masonry walls, except washroom walls.
2. System No. 13 surface preparation shall be SP C1.
3. System No. 13 filler shall be one coat of one of the following, or equal:
   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon, CMU only
   b. Porter 895 Unifill at 100 square feet per gallon.
   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
   d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.
4. System No. 13 finish shall be two (2) coats of one of the following, or equal:
   a. Tnemec Series 66 Epoxoline at 4.0-6.0 mils DFT per coat.
   b. Porter M.C.R.-43 High Build Semi-Gloss Epoxy at 5.0 mils DFT per coat.
   c. Glidden Epoxy Chemical Resistant No. 5240-50/5242 5.0 mils DFT.
   d. Induron Armorguard Epoxy at 4.0 mils DFT per coat.

N. System No. 14
1. System No. 14 shall be used for masonry walls requiring a tile-like epoxy finish, including but not limited to interior washroom walls.
2. System No. 14 surface preparation shall be SP C1.

3. System No. 14 filler shall be one coat of one of the following, or equal:
    a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon
    b. Porter 895 Unifill at 100 square feet per gallon.
    c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
    d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.
4. System No. 14 finish shall be two (2) coats of one of the following, or equal:
    a. Tnemec Series 84 Ceramlon at 4.0-6.0 mils DFT per coat.
    b. Porter: First coat, Porter M.C.R.-43 High Build Epoxy at 5.0 mils DFT. Second coat, Porter M.C.R.-43 Gloss Epoxy at 2.0 mils DFT.
    c. Glidden 5550 Series Glid-Guard Glid-Tile Epoxide Coating at 6.0 mils DFT per coat.
    d. Induron Perma-Clean II at 4.0 mils DFT per coat.

O. System No. 15
1. System No. 15 shall be used for exterior masonry requiring a matte finish.
2. System No. 15 surface preparation shall be SP C2.
3. System No. 15 filler shall be one coat of one of the following, or equal:
    a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon
    b. Porter 895 Unifill at 100 square feet per gallon.
    c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
    d. Induron primer not needed.
4. System No. 15 finish shall be two (2) coats of one of the following, or equal:
    a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.
    b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.
    c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.
    d. Induron AC 403 Acrylic Elastomeric at 6.0 mils DFT per coat.

P. System No. 16
1. System No. 16 shall be used for interior masonry requiring a matte finish.
2. System No. 16 surface preparation shall be SP C2.
3. System No. 16 filler shall be one coat of one of the following, or equal:
    a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon
    b. Porter 895 Unifill at 100 square feet per gallon.
    c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
    d. Induron AC 202 Acrylic Block Filler at 75 sq. ft. per gallon.
4. System No. 16 finish shall be two (2) coats of one of the following, or equal:
    a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.
    b. Porter 16 Series Acrylic Industrial Coating at 1.1 mils DFT per coat.
    c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.
    d. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.

Q. System No. 17
   1. System No. 17 shall be used for the following interior surfaces:
      a. Drywall
      b. Plaster
      c. Stucco
   2. System No. 17 surface preparation shall be SP P1 (Drywall) or SP P2 (Plaster and Stucco).
   3. System No. 17 primer shall be one coat of one of the following, or equal:
      a. Tnemec 51PVA Sealer at 1.5 mils DFT.
      b. Porter 767 Latex Primer Sealer at 3.0 mils DFT.
      c. Glidden 5019 Ultra-Hide PVA Primer-Sealer at 1.0 mils DFT.
      d. Induron AC 402 Acrylic Masonry Sealer at 1.0 mils DFT.
   4. System No. 17 finish shall be two (2) coats of one of the following, or equal:
      a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.
      b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.
      c. Glidden 3400 Series Spred Satin Latex Wall Paint at 1.4 mils DFT per coat.
      d. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.

R. System No. 18
   1. System No. 18 shall be used for the following exterior surfaces:
      a. Concrete columns and beams
      b. Stucco
   2. System No. 18 surface preparation shall be SP C2.
   3. System No. 18 filler shall be one coat of one of the following, or equal:
      a. Tnemec 54-561 Modified Epoxy Masonry Surfacer at 80 square feet per gallon.
      b. Porter 895 Unifill at 100 square feet per gallon.
      c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.
      d. Induron primer not needed.
   4. System No. 18 finish shall be two (2) coats of one of the following, or equal:
      a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.
      b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.
      c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.
      d. Induron AC 403 Acrylic Elastomeric at 6.0 mils DFT per coat.

S. System No. 20
   1. System No. 20 shall be used for exterior wood surfaces requiring a semi-gloss finish.
   2. System No. 20 surface preparation shall be SP W1.
   3. System No. 20 primer shall be one coat of one of the following, or equal:
      a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.
      b. Porter 515 Acrylic Bonding Primer at 1.5 mils DFT.
      c. Induron AC 301 Wood Primer at 1.5 mils DFT.

4. System No. 20 finish shall be two (2) coats of one of the following, or equal:
    a. Tnemec Series 1029 Enduratone at 2.0-3.0 mils DFT per coat.
    b. Porter 1660 Series Acrylic Enamel at 2.5 mils DFT per coat.
    c. Glidden Spred Ultra Gloss House Paint No. 6600 Series at 1.4 mils DFT per coat.
    d. Induron Armorlux 2500 at 1.5 mils DFT per coat.

T. System No. 21
1. System No. 21 shall be used for interior wood surfaces requiring a gloss finish.

2. System No. 21 surface preparation shall be SP W1.
3. System No. 21 primer shall be one coat of one of the following, or equal:
    a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.
    b. Porter 2429 I.A.-24 Undercoat at 2.0 mils DFT.
    c. Glidden Ultra Hide Alkyd Interior Enamel Undercoater No. UH400 at 1.5 mils DFT.
    d. Induron AC 301 Wood Primer at 1.5 mils DFT.
4. System No. 21 finish shall be two (2) coats of one of the following, or equal:
    a. Tnemec Series 1028 Endruatone Gloss @ 2.0-3.0 mils DFT per coat.
    b. Porter I.A.-24 Gloss Finish at 1.5 mils DFT per coat.
    c. Glidden 4550 Series Glid-Guard Alkyd Industrial Enamel at 2.0 mils DFT per coat.
    d. Induron Armorlux 2500 at 1.5 mils DFT per coat.

U. System No. 22
1. System No. 22 shall be used for interior wood surfaces requiring a semi-gloss finish.
2. System No. 22 surface preparation shall be SP W1.
3. System No. 22 primer shall be one coat of one of the following, or equal:
    a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.
    b. Porter 2429 I.A.-24 Undercoat at 2.0 mils DFT.
    c. Glidden Ultra Hide Alkyd Interior Enamel Undercoater UH400 at 1.5 mils DFT.
    d. Induron AC 301 Wood Primer at 1.5 mils DFT.
4. System No. 22 finish shall be two (2) coats of one of the following, or equal:
    a. Tnemec Series 1029 Enduratone at 2.0-3.0 mils DFT per coat.
    b. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.
    c. Glidden Ultra Hide Alkyd Semi-Gloss Enamel UH-8000 at 1.5 mils DFT per coat.
    d. Induron AC 240 Acrylic Semi-Gloss at 2.0 mils DFT per coat.

V. System No. 23
1. System No. 23 shall be used for interior wood surfaces requiring a low-sheen finish.
2. System No. 23 surface preparation shall be SP W1.
3. System No. 23 primer shall be one coat of one of the following, or equal:

a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.
b. Porter 515 Acrylic Bonding Primer at 1.5 mils DFT.
c. Glidden Ultra Hide Alkyd Interior Enamel Undercoater UH-400 at 1.5 mils DFT.
d. Induron AC 301 Wood Primer at 1.5 mils DFT.

4. System No. 23 finish shall be two (2) coats of one of the following, or equal:
a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.
b. Porter 16 Series Industrial Coating at 2.0 mils DFT per coat.
c. Glidden Ultra Hide Alkyd Eggshell Enamel No. 5000 Series.
d. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.

W. System No. 24 - ***Not Used***

1. System No. 24 shall be used for insulated and canvas-wrapped piping.
2. System No. 24 surface preparation shall be general cleaning.
3. System No. 24 primer shall be one coat of one of the following, or equal:
a. Tnemec 51-792 PVA Sealer at 1.5 mils DFT.
b. Porter 767 Latex Primer Sealer at 3.0 mils DFT.
c. Glidden 5116 Insul-Aid Vapor Barrier Primer-Sealer at 1.7 mils DFT.
d. Induron AC 210 Acrylic Primer at 1.5 mils DFT.
4. System No. 24 finish shall be two (2) coats of one of the following, or equal:
a. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.
b. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.
c. Glidden Ultra Hide Alkyd Semi-Gloss Enamel UH-8000 at 1.5 mils DFT per coat.
d. Induron AC 230 Acrylic Eggshell at 1.5 mils DFT per coat.

X. System No. 25

1. System No. 25 shall be used for metal surfaces.
2. System No. 25 surface preparation shall be SP 10.
3. System No. 25 shop primer shall be one coat of one of the following, or equal:
a. Induron PE-54 Primer at 3.0 to 5.0 mils DFT.
b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT
c. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.
d. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy No. 5465 Series at 3.0 mils DFT.
4. System No. 25 field touch-up shall be one of the following, or equal:
a. Induron Ruff Stuff 2100 Coal Tar Epoxy
b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT
c. Porter 4300 M.C.R.-43 Epoxy Primer.
d. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy No. 5465 Series at 3.0 mils DFT.
5. System No. 25 finish shall be two (2) coats of one of the following, or equal:
a. Induron Ruff Stuff 2100 Coal Tar Epoxy at 8.0 mils DFT per coat; apply second coat within 90 days of first coat.
b. Tnemec Series 446 Perma-Thane @ 5.0-7.0 mils DFT per coat; apply

second coat within 96 hours of first coat.

c. Porter 7013 Tarset C-200 Black at 8.0 mils DFT per coat; apply second coat within 24 hours of first coat.

d. Glidden 5270-1 Glid-Guard Coal Tar Epoxy Finish at 8.0 mils DFT per coat; apply second coat within 24 hours of first coat.

Y. System No. 26

1. System No. 26 shall be used for concrete surfaces.
2. System No. 26 surface preparation shall be SP C1.
3. System No. 26 finish shall be two (2) coats of one of the following, or equal:
   a. Induron Ruff Stuff 2100 Coal Tar Epoxy at 8.0 mils DFT per coat; apply second coat within 90 days of first coat.
   b. Tnemec 46H-413 Tneme-Tar at 8.0-10.0 mils DFT per coat; apply second coat within 96 hours of first coat.
   c. Porter 7013 Tarset C-200 Black at 8.0 mils DFT per coat; apply second coat within 24 hours of first coat.
   d. Glidden 5270-1 Glid-Guard Coal Tar Epoxy Finish at 8.0 mils DFT per coat; apply second coat within 24 hours of first coat.

Z. System No. 27

1. System No. 27 shall be used for steel surfaces in potable water immersion.
2. System No. 27 surface preparation shall be SSPC-SP 10 Near White Metal Blast.
3. System No. 27 shop primer shall be one coat of the following system or equal:

   a. Induron PE-54 Primer at 3.0 - 5.0 mils DFT.
   Induron PE-54 Int./Finish at 3.0 - 5.0 mils DFT per coat

   b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT
   Stripe coat welds and seams using Tnemec Series N140-1255 Beige Pota-Pox Plus @ 3.0-5.0 mils DFT
   .Intermediate Coat: Tnemec Series N140-15BL Tank White Pota-Pox Plus @ 4.0-6.0 mils DFT
   Finish Coat: Tnemec Series N140-00WH White @ 4.0-6.0 mils DFT.

AA. System No. 28

1. System No. 28 shall be used for concrete surfaces in potable water immersion.

2. System No. 28 surface preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 MortarClad at an average of 1/16". .
3. System No. 28 shop primer shall be one coat of the following system or equal: Coating System:
   a. Primer: Tnemec Series N140-1255 Beige Pota-Pox Plus @ 3.0-5.0

mils DFT

b. Intermediate Coat: Tnemec Series N140-15BL Tank White Pota-Pox Plus @ 4.0-6.0 mils DFT

c. Finish Coat: Tnemec Series N140-00WH White @ 4.0-6.0 mils DFT.

4. System No. 28 field touch-up shall be one coat of the following system or equal:

a. Induron PE-54 Primer at 3.0 to 5.0 mils DFT.

b. Finish: Two full coats of the following system or equal:

c. Induron PE-54 Int./Finish at 3.0 to 5.0 mils DFT per coat.

BB. System No. 29

1. System No. 29 shall be used for all non-painted, exposed concrete flooring surfaces.
2. System No. 29 surface preparation shall be SP C1
3. System No. 29 shall be three coats of Sonneborn "Kure-N-Seal", Euclid Chemical Co. "Surfhard", or Lambert Corp. "Solidus" applied per the manufacturer's installation instructions, or an approved equal.

PART 3 - EXECUTION

3.01 GENERAL

All painting shall be done in strict accordance with the recommendations of the manufacturer and shall be performed in a manner satisfactory to the County/Engineer.

A. All recommendations of the paint manufacture in regard to mixing, applying, thinning and curing as well as the health and safety of the workers shall be followed.

B. Dry film thickness for masonry is approximate for application to a smooth surface.

C. Sequence painting to ensure work area is dust free.

3.02 MIXING

A. Exercise care to keep fire hazards to a minimum. Provide an approved hand fire extinguisher near each paint storage and mixing area. No oily waste, rags, or painting equipment shall be left scattered throughout the premises.

B. Mix coatings in accordance with manufacturer's instructions. Colors shall be thoroughly mixed with no streaks or separation of color. Do not add thinners, driers or other additives except as recommended by the coating manufacturer. Do not incorporate in the coating any thinners or solvents used for cleaning brushes or equipment.

C. Protect all adjacent areas against damage and leave storage and mixing areas clean at

the completion of painting.

3.03 ACCEPTANCE OF SURFACES

A. Inspect all surfaces and adjoining work and report to the E/A in writing any existing unsatisfactory conditions. No painting work shall be started until the unsatisfactory conditions are remedied.

B. Commencement of surface preparation and painting shall constitute the acceptance of existing conditions and any defects appearing in the painting work thereafter shall be by the Contractor at no additional cost.

3.04 PROTECTION OF ADJACENT SURFACES

A. Provide necessary protection for completed work and all adjoining surfaces. Provide temporary closures as required to prevent circulation of dust from adjacent areas where other work is in progress. Where it is necessary to remove existing protection of work of others, such protection shall be fully replaced.

B. Locate and protect all existing utilities, structures, or appurtenances.

3.05 VENTILATION

A. Provide adequate ventilation for safe application and for proper drying of coatings on interior surfaces. Ensure solvent vapors are released during and after application of coatings. Remove vapors by exhausting air from the lowest portions of tanks or enclosed spaces and keep tops open and clear. During coating application in enclosed areas the capacity of ventilating fans shall be at least 300 cfm per gallon of coating applied per hour. Provide continuous forced ventilation at a rate of at least one complete air change per 4 hours for at least 7 days after coating application is completed.

3.06 GENERAL SURFACE PREPARATION REQUIREMENTS

A. Prepare all surfaces in accordance with the coating manufacturer's instructions and specified. Surfaces shall be uniform texture, dry, and free from dust, grit, oil, grease, or any material which will adversely affect adhesion or appearance of the coating. Rough edges of metal, weld seams and sharp edges from scaffold lugs shall be ground to a curve.

B. Surfaces that have been cleaned, pretreated, and/or otherwise prepared for painting shall be given a coat of the first-coat material as soon as practicable prior to any deterioration of the prepared surface.

C. Hardware, accessories, plates, fixtures, and similar items in contact with coated surfaces shall be removed, masked, or otherwise protected prior to surface

preparation and painting operations.

D. Exposed nails and other ferrous metals on surfaces to be coated shall be spot- primed with a metal primer compatible with the finish.

3.07 SURFACE PREPARATION

A. Surface Preparation SP 3 - Power Tool Cleaning
   1. Remove all oil and grease from surface. Power tool clean the surface removing all loose mill scale, loose rust, loose paint and other detrimental foreign matter by the methods outlined in the SSPC SP 3. Feather out edges of chipped or abraded areas to prevent flaws from showing through finish coats.
   2. The cleaned surface shall be primed as soon as possible and before any rusting of the surface occurs.

B. Surface Preparation SP 6 - Commercial Blast Cleaning
   1. Remove all oil and grease from the surface. Blast clean surface to a Commercial Finish, removing mill scale, dirt, rust, and foreign matter by the methods outlined in SSPC SP 6. Two thirds of each square inch of surface area shall be free of all visible residues.
   2. Blasting shall be done with centrifugal wheel or compressed air blast using either steel grit or flint silica sand. Abrasive should provide a profile depth of 1.0 to 2.0 mils. Steel Grit #G-80 or flint silica sand 20-50 mesh is recommended to obtain proper profile depth. Remove all dust and sand by vacuuming.
   3. The blast cleaned surface shall be primed as soon as possible and before any rusting of the surface occurs.

C. Surface Preparation SP 7 - Brush-Off Blast : Prepare metal as outlined in SSPC SP 7 to provide for proper adhesion of coating.

D. Surface Preparation SP l0 - White Blast Cleaning
   1. Steel surfaces shall be dry and clean. Remove all grease, oils and contaminants with rags soaked in toluol or xylol. Solvent Clean all surfaces per SSPC-SP 1 Solvent Cleaning.
   2. Remove all weld spatter. Grind all rough welds and sharp edges to a smooth rounded contour. Blast clean the surface to a Near White Metal finish, removing nearly all mill scale, rust, rust-scale, paint or foreign matter by the recommended methods outlined in SSPC SP l0. At least 95 percent of each square inch shall be free of all visible residues and staining.
   3. Blasting shall be done with centrifugal wheel or compressed air blast nozzles using either steel grit or flint silica sand. Abrasive should provide profile depth of l.0 to 2.0 mils. Steel Grit #G-80 or flint silica sand 20-50 mesh is recommended to obtain proper profile depth. Remove all dust and sand by vacuuming.
   4. The blast cleaned surface should be primed as soon as possible and before any

rusting of the surface occurs.

E. Surface Preparation SP C1 - General Cleaning: Allow concrete and masonry to cure in place for 28 days. Remove all dirt, dust, form oil, curing compounds, grease stains, or efflorescence from surfaces and roughen as required to provide good adhesion of coatings. If washing of the surface is required, use tri-sodium phosphate solution followed by a clean water rinse. Fill all minor holes to produce uniform surface textures.

F. Surface Preparation SP C2 - Sweep Sand Blasting
1. Concrete surfaces must be clean, dry and free of existing coatings. Cure new concrete a minimum of 28 days. Fill and seal structural cracks and defects.
2. Concrete shall be cleaned and etched by sweep sandblasting (brush-off blast) so the surface is grainy to the touch. All dust or foreign matter shall be removed by vacuuming.

G. Surface Preparation SP C3 - Acid Etching (Horizontal Surfaces Only)
1. Concrete surfaces must be clean and dry. Cure new concrete a minimum of 28 days. Remove all dirt, dust, grease, oil and other contaminants from surface.
2. Etch concrete surface with l5 to 20 percent muriatic acid. Thoroughly coat the concrete with solution applied with a mop or brush. When foaming stops, thoroughly neutralize with clear water to remove soluble salts. Test the rinse water with litmus paper to verify the neutralization.
3. After etching, the surface shall be "grainy" to the touch; if not, repeat the treatment.
4. Permit surface to thoroughly dry a minimum of 72 hours before coating, while maintaining the cleanliness of the surface.

H. Surface Preparation SP M1 - Solvent Cleaning: Non-ferrous and galvanized ferrous surfaces scheduled to receive paint shall be solvent cleaned to remove all oils, salts, and contaminants prior to application of pretreatments or primers.

I. Surface Preparation SP P1 – Drywall: Fill all surface irregularities with spackling compound and sand to a smooth level surface prior to applying finish. Care shall be exercised to avoid raising nap on the paper.

J. Surface Preparation SP P2 - Plaster and Stucco: Rake cracks, scratches and abrasions deeply. Soak with water and fill with patching plaster or spackling compound. Treat with aqueous solution of zinc sulphate, 4 lbs. to l gallon of water. Add to solution enough phenophthalein to act as a color warning of alkali. Allow to dry for 3 days. Remove loose crystals before coating.

K. Surface Preparation SP W1 – Wood: Sandpaper to a smooth even surface and vacuum or dust off. Treat all knots and sap spots with mineral spirits and, when dry, touch up with an approved sealer. Subsequent to priming and staining, thoroughly fill holes and cracks with plastic wood filler for transparent finishes and putty for painted wood.

Unless otherwise approved, paint only when the moisture content of the wood is below l2 percent. Do not apply primer or sealer to wood in areas where cement, mortar, or plaster is not thoroughly dry.

3.08 APPLICATION

A. All work shall be performed by skilled painters. Surfaces shall be free of drops, ridges, waves, laps and brush marks. Edges of paint adjoining other colors or materials shall be sharp and true.

B. Do not apply coatings in temperatures below 50 degrees F except where the manufacturer specifically allows for lower temperatures. No exterior painting shall be done during inclement weather when relative humidity exceeds 85%, the ambient temperature is within 5 degrees F of the Dew Point or under conditions identified by the manufacturer as unsuitable.

C. The average rate of application shall not exceed the theoretical rate of coverage recommended by the coating manufacturer for the type of surface involved, less an allowance for losses. Average DFT shall not be less than thickness set forth under Painting Systems. Not more than l0-20% of points inspected may be less than 90% of the specified thickness. Deficiencies shall be corrected by application of additional coating.

D. Each coat shall be uniform in coverage and color. Successive coats shall perceptibly vary in color. Each coat shall be carefully examined and faulty material,

poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Comply with coating manufacturer's recommendations for drying time between coats.

E. Bottoms, sides and edges of doors shall receive same finish as faces of doors. If refitting of wood doors is done prior to final acceptance, refinish at no extra cost.

F. Incidental niches, recesses, passages, closets, etc., shall be finished to match similar or adjacent spaces. Access doors, panels, convectors, grilles and similar items shall be coated the same color as adjacent work, except for non-ferrous metal or where otherwise directed by the E/A. Primed hardware shall be coated to match adjacent work to which they are attached.

G. In the event that the finished surfaces are not acceptable, completely refinish entire unit areas or sections as necessary in order to eliminate visible laps or other indications of repairs.

H. Mixing, thinning, pot life, application procedure, equipment, coverage, curing, re-coating, storage and number of coats shall be in accordance with coating manufacturer's instructions.

I. Avoid degradation and contamination of blasted surfaces, and avoid between coat contamination. Surfaces contaminated shall be cleaned before applying next coat. Method of cleaning contaminated surface shall be approved by the Engineer or County's representative.

J. Each application of material shall be worked into corners, crevices, joints, etc., and distributed evenly over flat surfaces. Spraying techniques that result in a uniform wet pattern shall be used and dry spraying should be avoided. Dry spray shall be removed prior to coating being applied.

K. All bolts, welds, sharp edges, and difficult access areas shall receive a primer brush coat or spray coat prior to primer spray application.

3.09 PIPE COLOR CODING

A. Coat all exposed piping, conduit and appurtenances to conform to a color code as approved by the E/A.

B. Submit for the E/A to approve a coating schedule for the color coding of exposed piping, conduit and appurtenances.

C. Color code shall be as set forth in the Recommended Standards for Water Works (Ten-State Standards).

3.10 CLEAN-UP

At completion of the painting work, clean off all paint spots and other paint materials from surfaces where they are not intended to be. Remove from the premises all rubbish and accumulated material and leave the work in clean orderly condition, acceptable to the E/A. All cloths and waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site and/or destroyed in an approved and legal manner.

3.11 EXTRA STOCK

Upon completion of painting work, the County shall be furnished at no additional cost, one gallon of each type and color of finish paint for touching up. Paint container labels shall be complete with the manufacturer's name, generic type, number, color and location in which the paint is applied.

3.12 DAMAGED COATINGS

A. Damaged coatings, pinholes, and holidays shall have edges feathered and repaired in

accordance with the recommendations of the manufacturer, as approved by the Engineer.

B. All finish coats, including touch up and damage-repair coats shall be applied in a manner which will present a uniform texture and color-match appearance.

3.13 UNSATISFACTORY APPLICATION

A. If the item has an improper finish, color, or insufficient dry film thickness, the surface shall be cleaned and top coated with the specified material to obtain the specified color and coverage. Specific surface preparation information to be secured from the coatings manufacturer and the Engineer.

B. All visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the specifications.

C. Work shall be free of runs, bridges, shiners, laps, or other imperfections. Evidence of these conditions shall be cause for rejection.

D. Any defects in the coating system shall be repaired by the Contractor per written recommendations of the coating manufacturer.

E. Any repairs made on steel surfaces for immersion service shall be holiday detected in accordance with ASTM G 62 low voltage holiday detection. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The Engineer shall be notified of time of testing so that he might be present to witness testing.

3.14 GUARANTEE AND ANNIVERSARY INSPECTION

A. All work shall be warranted for a period of one year from date of acceptance of the project.

B. The County will notify the Contractor at least 30 days prior to the anniversary date and shall establish a date for the inspection. Any defects in the coating system shall be repaired by the Contractor at no additional cost to the County. Should a failure occur to 25% of the painted surface, either interior or exterior, the entire surface shall be cleaned and painted in accordance with these specifications.

END OF SECTION

SECTION 09966

GRAFFITI RESISTANT COATINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

This specification covers preparation, materials, services, and equipment required for the application of a Graffiti Resistant Coating for projects involving either old or new construction. Any substantial deviations shall be referred to the manufacturer.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 03300 – Cast-in-Place Concrete

1.03 SUBMITTALS

A. Submit in accordance with Section 01300 Submittals.

B. Product Data: Submit manufacturer's product data sheets for the specified graffiti resistant coatings and cleaners. Submit description for protection of surrounding areas and non-masonry surfaces, surface preparation, application, and final cleaning.

C. Applicator Qualifications: Submit qualifications of applicator; stating applicator is an approved applicator from the manufacturer being supplied. Provide a list of several most recently completed projects, including project name and location, names of County and architect, and description of products used, substrates, and method of application.

D. Environmental Regulations: Submit applicable environmental regulations.

E. VOC Certification: Submit certification that graffiti resistant coatings furnished comply with regulations controlling content of volatile organic compounds (VOC).

1.04 QUALITY ASSURANCE

A. Applicator Qualifications
   1. Experience in the application of the specified or compatible products.
   2. Employs persons trained for the application of the specified products or compatible products.

B. Contractor shall schedule a pre-application meeting a minimum of two (2) weeks before the start of application of graffiti resistant coatings. Require attendance of parties directly affecting work of this section, including the Contractor, County, applicator, and manufacturer representative. Review environmental regulations, test

panel procedures (if required), protections of surrounding areas and non-masonry surfaces, surface preparation, application, field quality control, completion of warranty information, final cleaning, and coordination with other work.

1.05 ENVIRONMENTAL REGULATIONS

A. Comply with applicable federal, state, and local environmental regulations.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in original, tightly sealed, unopened containers, with labels clearly identifying product name and manufacturer. Verify that the product matches that of the original sample applied on the test panel.

B. Store containers upright in a cool, dry place. Keep away from sparks and open flame. Store and handle materials in accordance with manufacturer's written instructions. Must use product within 8 hours of opening container.

C. Warranty shall be given for three (3) years from substantial completion.

1.07 PROJECT CONDITIONS

A. Surface Preparation: Contractor or applicator shall be responsible for providing a clean, dry substrate free from oil, dirt, grease, efflorescence or any other coating which may inhibit penetration and adhesion of graffiti resistant coating. This requirement applies to new construction, renovation or remedial projects. Substrate must be completely dry prior to applying product.

B. Environmental Requirements

1. Temperature: Product may be applied at any temperature providing that there is no frozen moisture present in the substrate. When applied at temperatures below 40 degrees Fahrenheit the product may cure at a slower rate. Optimal temperatures should be above 40° F (5° C) or below 95° F (35° C).
2. Do not apply material if the substrate is wet or contains frozen moisture. Allow substrate to dry for a minimum of 48 hours after rain or power washing.
3. Do not apply material during inclement weather or if precipitation is expected within 12 hours.
4. Do not use spray methods of application under windy conditions.

C. Protection

1. Special precautions should be taken to avoid fumes from entering the building being treated. Ventilation systems and fresh air intakes should be turned off and covered.
2. Protect shrubs, metal, glass, vehicles, and other building hardware from overspray.

PART 2 - PRODUCTS

2.01 GRAFFITI RESISTANT COATINGS

A. Graffiti Resistant Coating shall be applied in two (2) coats. Apply the penetrating silicone rubber graffiti resistant coating on above grade vertical concrete. The anti-graffiti coating shall be non-sacrificial and will withstand repeated cycles of graffiti tagging and removal with no requirement to reapply the sealant. The product will not be affected by UV rays, salts, acid rain, etc. The product should be breathable and allow moisture vapor to escape while preventing liquid penetration. The product shall be flexible to bridge hairline cracks and allow for building movement. The product will provide waterproofing protection as well as a graffiti barrier.

1. Form: Liquid
2. Color: Clear
3. Active Substance: RTV Silicone Rubber
4. Percent Active Material: 15%
5. Flash Point: 105°.

B. The graffiti resistant coating product listed above is selected as a standard of quality. Application procedure and coverage rates must be in conformance with effectiveness of testing samples submitted, recommendation of application rates suggested, approved manufacturers standards and as a minimum, that specified herein.

C. Proposed alternate products must be equal in terms of chemical composition and performance standards. Products must be penetrating permanent treatments using a silicone rubber base and not contain any paraffin waxes, urethanes or polysiloxanes. Silane and siloxane based products will not be considered because of their lack of elongation (400%), allowing for thermal expansion and contraction. Products must be non-sacrificial, allowing for repeated cycles of tagging and cleaning without the requirement of reapplication of the sealant.

PART 3 - EXECUTION

3.01 EXAMINATION

Verify the following:

A. The required joint sealants have been installed.

B. New masonry and mortar has cured a minimum of 28 days.

C. Surface to be treated is clean, dry and contains no frozen moisture.

D. Environmental conditions are appropriate for application.

3.02 PROTECTION

A. Protect surrounding areas, glass, landscaping, building occupants, pedestrians, vehicles, and non-masonry surfaces during the work from contact with graffiti resistant coatings.

B. Special precautions should be taken to prohibit fumes from entering the building being treated. Ventilation systems and fresh air intakes should be turned off and covered.

3.03 SURFACE PREPARATION

A. Clean all dirt, oil, grease, mold, mildew, efflorescence, or any other coating or material from surfaces that interfere with penetration, performance, adhesion, or aesthetics of graffiti resistant coatings. Rinse thoroughly, using pressure water spray to remove cleaner residues. Allow surfaces to dry completely before application of graffiti resistant coatings.

B. Repair, patch, and fill all cracks, voids, defects, and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before application of graffiti resistant coatings.

C. Seal all open joints.

D. Allow new masonry and concrete construction and repainted surfaces to cure for a minimum of 28 days before application of graffiti resistant coatings.

3.04 APPLICATION

A. Apply graffiti resistant coatings to substrates in accordance with manufacturer's written instructions and environmental regulations. Graffiti protection requires a two-coat application.

B. Apply to clean, dry, cured, and properly prepared surfaces approved by County.

C. Apply material as shipped by the manufacturer. Do not dilute.

D. Do not apply to below-grade surfaces.

E. Do not apply to painted surfaces.

F. Do not apply to compensate for structural or material defects in substrates.

G. Do not apply to substrates such as asphalt or polystyrene, which may be affected by the solvent carrier.

H. Apply material using a high-volume, low pressure, pump-up sprayer (between 40-50 psi), with solvent resistant fittings, foam roller, or brush of natural bristle or foam.

Vertical Applications: Apply in a flood coat, from top to bottom, being sure to obtain a 4 to 6 inch rundown of product from the point where the spray makes contact with the surface. Work all the way down the building covering the rundown as you go. Avoid excessive overlapping. Allow first coat to dry to the touch prior to applying second coat. Apply the second coat by flood coating from the top down.

3.05 FIELD QUALITY CONTROL

A. Inspection: Inspect the graffiti resistant coating work with the Contractor, County, applicator, and manufacturer representative. Determine if the substrates are suitably protected by the graffiti resistant coatings.

B. Manufacturer's Field Services: Provide the services of a manufacturer's authorized field representative to verify specified products are used; protection, surface preparation, and application of graffiti resistant coatings are in accordance with the manufacturer's written instructions.

3.06 FINAL CLEANING

A. Upon completion of all work covered in a specification, the Contractor shall remove all equipment, material and debris, leaving the area in an undamaged and acceptable condition. Dispose of graffiti resistant coating containers according to state and local environmental regulations.

B. Repair, restore, or replace to the satisfaction of the County, all materials, landscaping, and non-masonry surfaces damaged by exposure to graffiti resistant coatings.

END OF SECTION

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SECTION 10400

IDENTIFYING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere:

A. Work under this Section includes:
   1. Safety signs.
   2. Engraved plastic laminate signs.
   3. Dedication plaque.

B. Related work specified elsewhere includes:
   1. Division 15 Mechanical
   2. Electrical Identification - Section 16195.

1.02 SUBMITTALS

A. Shop Drawings and Product Data
   1. Submit shop drawings and product data for the products of this Section in compliance with Section 01300.

B. Samples
   1. Submit samples of plastic laminate for approval by the County.

PART 2 - PRODUCTS

2.01 SAFETY SIGNS

A. Provide safety signs as specified herein and as indicated on the Drawings. Safety signs shall comply with OSHA requirements Section 1910.145. Signs shall be 10" by 14" horizontal signs of minimum 20-gauge steel with a baked-on enamel finish. "Caution" signs shall be yellow and black. "Danger" signs shall be red and black.

B. Floor Load Caution Signs
   1. Provide floor load caution signs where indicated and for the loads indicated on the Drawings. Provide a minimum of one floor load caution sign for each area or room on a structural slab.
   2. Floor load caution signs shall be lettered as follows:

CAUTION
CAPACITY ____ LBS
FLOOR LOAD
PER SQUARE FOOT

C. Fire Extinguisher Sign
   1. Provide location signs for all fire extinguishers both inside or outside the building.
   2. Sign shall be lettered as follows:

FIRE EXTINGUISHER

D. Emergency Egress Identification Signs
   1. Provide signs at all emergency egress openings and not readily identifiable secondary egress doors.
   2. Signs shall be lettered as follows:

EMERGENCY EGRESS
KEEP AREA CLEAR

E. No Combustible Storage Signs
   1. Provide signs in all mechanical and electrical areas.
   2. Signs shall be lettered as follows:

COMBUSTIBLE STORAGE
NOT PERMITTED

F. High Voltage Warning Signs
   1. Provide signs on all doors leading to the electrical equipment room
   2. Arc Flash Labeling
   3. Signs shall be lettered as follows:

DANGER – HIGH
VOLTAGE

G. No Smoking Signs
   1. Provide signs on all doors leading into the building.
   2. Signs to be lettered as follows:

NO SMOKING

H. Hearing Protection Required Signs
   1. Provide signs on all doors leading into the building pump area.
   2. Signs to be lettered as follows:

2.02 ROOM IDENTIFICATION SIGNS

A. Provide room identification signs on walls directly adjacent to doors entering specified rooms. Room identification signs shall be minimum 10” by 5” horizontal signs of minimum 20-gauge steel with baked-on enamel finish.

B. Electrical Equipment Room sign
   1. Provide signs on all doors leading to the Electrical Equipment Room.

2. Signs to be lettered as follows:

ELECTRICAL EQUIPMENT ROOM

C. Pump Room Sign
1. Provide signs on all doors leading into the Pump Room.
2. Signs to be lettered as follows:

PUMP ROOM

2.03 PUMP IDENTIFICATION SIGNS

A. Provide pump identification signs for each pump. The signs shall be numbered to coincide with the controls in the Electrical System and SCADA system. The signs shall be a minimum of 4" by 2" and mounted at the base of each pump.

2.04 ENGRAVED PLASTIC LAMINATE SIGNS

A. Provide engraved plastic laminate signs as follows:

1. Provide _____ signs ____ -inch by ____ -inch with ____ -inch high letters.

2. Provide _____ signs ____ -inch by ____ -inch with ____ -inch high letters.

3. Provide _____ signs ____ -inch by ____ -inch with ____ -_inch high letters.

B. Plastic laminate shall be 1/8" thick with face and core colors as selected by the Engineer. Color selection will be made from the supplier's standard colors. However, the supplier shall provide a minimum of 10 colors for the Engineer's consideration.

C. Engraved letters shall be machine cut evenly into the contrasting color core. Letter style shall be Helvetica Medium.

2.05 LABELS FOR VALVES

A. Provide each valve of size larger than 2 inches with an identification tag. Tag shall be 2 inches square or circular brass or 1/16-inch thick fiberglass. Brass tags shall have black-filled letters. Tag shall show the valve asset number as given on the drawings.

2.06 DEDICATION PLAQUE – N/A

PART 3 - EXECUTION

3.01 INSTALLATION

Install identification devices in a permanent manner as approved by the County.

END OF SECTION

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SECTION 10441

PLASTIC SIGNS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Injection molded signs.

1.02 REFERENCES

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 1998.

1.03 SUBMITTALS

A. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.

B. Manufacturer's Installation Instructions: Include installation template and attachment devices.

1.04 DELIVERY, STORAGE, AND PROTECTION

A. Package signs, labeled in name groups.

B. Store adhesive attachment tape at ambient room temperatures.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Plastic Signs:
   1. Best Sign Systems, Inc: www.bestsigns.com.
   2. Mohawk Sign Systems, Inc: www.mohawksign.com.
   3. Seton Identification Products: www.seton.com/aec.
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 INJECTION MOLDED SIGNS

A. Base Material: Acrylic plastic.
   1. Comply with applicable provisions of ANSI/ICC A117.1, including Braille.
   2. Sign Color: Color as selected.
   3. Character Color: Contrasting color.
   4. Total Thickness: 1/8 inch.
   5. Character Height: 3/4 inches.
   6. Edges: Radiused
   7. Character Font: Helvetica Medium.

2.03 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install signs after doors are finished, in locations indicated.

END OF SECTION

SECTION 10523

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association; 2007.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.05 SUBMITTALS

A. Product Data: Provide extinguisher operational features.

B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Potter-Roemer: www.potterroemer.com.
   4. Substitutions: See Section 01630 – Product Selection and Substitution Procedures.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Class 3-A:40-B:C.
   2. Size 10.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.
   1. Sized to accommodate accessories.

C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

D. Door Glazing: Glass, clear, 1/8 inch thick float. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers and accessories in cabinets or mount on brackets as noted on drawings.

END OF SECTION

SECTION 11210

HORIZONTAL SPLIT-CASE PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work covered in this Section shall include, but is not limited to, furnishing all labor, materials, equipment, tools, and all incidental items and work required for construction, installation and testing of VFD-controlled horizontal split-case pumps, motors, control systems and related equipment and appurtenances and all items shown or inferred on the Contract Drawings or reasonably specified herein for the Potable Water Booster Pump Station.
2. It is the intent of these Contract Drawings that a complete, functional and fully operational Potable Water Booster Pump Station be constructed. If any items for a complete job are omitted or not shown, the Contractor shall furnish and install the same without additional cost to the County.
3. The Contractor shall provide all pipe supports required for "fully" supporting all suction and discharge piping, valving, and appurtenances associated with the Potable Water Booster Pump Station pumping system.
4. The Contractor shall have the sole responsibility for the proper functioning of the equipment.

B. Equipment furnished and installed under this Section shall be fabricated, assembled, erected and placed in proper operating condition in full conformance with detail drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the County.

C. Related Work Specified Elsewhere
1. Potable Water System - Section 02660
2. Electrical - Division 16

1.02 QUALITY ASSURANCE

A. Material Service Requirements
1. The pumps, motors, and all related equipment shall be suitably constructed of materials to withstand the operating conditions which shall be experienced during the pump's performance.

B. Balancing
1. All pump and motor units shall be statically and dynamically balanced.

2. The vibration allowance in the units shall not exceed the upper limits as established by the Hydraulic Institute Standards.

C. Tests

1. Each pump with its own factory calibrated drive motor shall be fully tested on water at the pump manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed for head, capacity, efficiency, and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve.
2. Certified copies of test reports shall be submitted to the Engineer prior to delivery of the pumps.
3. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests. During these tests the pumps with drive motors shall be checked for balance.
4. Motors shall be given a short commercial test in accordance with IEEE standards.

D. Unit Responsibility

1. The entire pump, motor and assembly shall be supplied by the pump manufacturer to insure unit responsibility.

E. The equipment specified under this section shall be provided by manufacturers who are fully experienced, reputable, qualified, and regularly engaged in the manufacture of the components and equipment to be furnished. All equipment and manufacturers shall be approved by the County.

D. The horizontal split-case pumps shall be manufactured in accordance with these specifications by a manufacturer whose high quality has been demonstrated by at least five (5) years of service in similar installations.

E. Minor Changes and Equipment Drawings

1. The structures shown on the Contract Drawings for the various items of equipment are the result of the best obtainable information from various sources. Due to the variances in equipment details between equipment manufacturers, the Contractor may find it necessary to make minor changes in order to accommodate the piping and the equipment furnished. The Contractor shall not undertake to construct any structure containing equipment until he has obtained approved, certified dimension prints of the equipment involved. Any structural changes necessary to accommodate the equipment furnished shall be approved by the County and shall be made at no additional cost to the County.
2. The equipment suppliers for the various items of equipment shall assume all responsibility in informing the Contractor of any changes that may be required in the structures, mechanical system, electrical or controls systems

to accommodate their equipment. Where details of equipment vary considerably from that shown, the equipment supplier shall prepare complete installation drawings, following the form of the Contract Drawings and such other drawings as may be required by the County to provide complete installation drawings. Where changes require such drawings, the equipment supplier shall furnish to the Engineer AutoCAD drawings in addition to approval prints.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. The Contractor shall submit the following to the Engineer for approval prior to fabrication and purchase.

a. Manufacturer's specification data and descriptive literature, illustrations, and applicable data for each pump. Show details of construction by ASTM reference and grade. Show outline dimensions and weights of pumps, bases and motors.

b. The Shop Drawings shall include details of pump assembly, installation layout and procedures, piping and electrical connections and requirements, types of materials used in the construction of the pump, details on all pump accessories; dimensions of major components, weights, structural and operating features, space required, clearances, type of finish or shop coat, and other pertinent data. Where applicable, and the pump is provided as part of a complete package inclusive of controls, control diagrams will be provided.

c. Lubricants

1) Pumps and drive units shall be delivered with the equipment fully lubricated insofar as possible. If any point cannot be so serviced, it shall be clearly marked to the effect that it is not lubricated and requires servicing prior to operation.

2) An adequate supply of proper lubricant, with instructions for its application, shall be supplied with the equipment for each point not lubricated prior to shipment.

d. A list of manufacturer’s recommended spare parts to be supplied, with the manufacturer’s part number (SKU #) and current price for each item. See Article 2.02(H) of this specification section. List bearings by the bearing manufacturer’s numbers only. Information about the nature and location of parts, service crews and repair facilities shall also be supplied.

e. The following data shall be provided on the drive motor:

1) Manufacturer’s name and model number

2) Materials of construction

3) Dimensions

4) RPM at full load
5) Frequency
6) Voltage
7) Full load current
8) Code and design letter
9) Efficiency
10) Horsepower Output
11) Number of phases
12) Time rating
13) Temperature rise
14) Service factor
15) Bearing life rating
16) Results of commercial test

f. The submittal shall include the motor manufacturer's recommended lubrication requirements and motor efficiencies and power factors at 50%, 75% and 100% of full load. Submit verification of minimum requirements for Duke Energy's motor efficiency credit.

g. Submit operation and maintenance data as specified in Section 01730, "Operation and Maintenance Data". Submit the equipment supplier's certificate that the installation is in accordance with suppliers recommendations.

h. Performance Curves

1) The Contractor shall submit the following to the County for approval, prior to shipment from the factory:

a) Submit manufacturer's certified pump performance curves for each pump and motor combination furnished illustrating pump characteristics of head, discharge flow, efficiency from 0 - 110% of the design capacity, required NPSH, available suction lift, impeller size, motor speed, and horsepower for the full range of head conditions specified. Provide performance curves for the full operating range.

b) The manufacturer's certified pump curves shall be submitted on 8½" x 11" sheets, at as large a scale as is practical. The certified curves shall be plotted from no flow at shut off head to maximum pump runout head and gallonage allowed by the manufacturer.

c) Points of operation which cause bearing stress or shaft deflection in excess of the manufacturer's tolerances for continuous operation shall be indicated on the submitted certification curves.

i. Manufacturer's guarantee and warranty.

j. Drawings showing general dimensions, connections, setting diagrams and wiring directions.

k. Procedures for proper installation.
l. The shop drawing submittals shall be complete in one (1) submittal.

B. Factory Performance Test Data
1. After acceptance of the pump shop drawings, factory performance test data will be submitted for approval on the pumping unit.
2. The test shall be a non-witnessed performance test.
3. Tests shall be in accordance with the standards of the Hydraulic Institute including head, capacity, brake horsepower, pump efficiency and NPSH.

1.04 OPERATION AND MAINTENANCE DATA

A. O&M Manuals shall be furnished for this Project in accordance with Section 01700, "Project Closeout" and shall be submitted in accordance with Section 01300, "Submittals". Contractor to submit three (3) complete bound sets of O&M manuals as well as a PDF that is searchable by keyword.

B. The O&M Manuals shall be ***prepared specifically for this installation*** and shall include but not be limited to the following:
1. Equipment function.
2. Description.
3. Normal and limiting operating characteristics.
4. Installation instructions (assembly, alignment and adjustment procedures).
5. Detailed operating and maintenance instructions (normal start-up and shutdown procedures, normal operating conditions and emergency situations)
6. Specifications relative to the assembly, alignment, checking, lubrication, placing in operation, adjustment, and maintenance of equipment and auxiliaries furnished under this Contract.
7. Parts list with catalog numbers and predicted life of parts subject to wear
8. Copies of shop drawings, certified dimensions drawings and design calculations, required cut sheets, drawings (cross sectional view, assembly, wire list and wiring diagrams), equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment.
9. Lubrication and maintenance instructions.
10. Troubleshooting guide.
11. Performance curves.
12. Instruction bulletins Manuals.

C. All such material shall be in addition to any instructions or parts lists packaged with or attached to the equipment when delivered.

D. The "final" O&M Manuals shall contain plastic laminated pull-out lubrication and

maintenance cards detailing all lubrication points, lubricant type, and frequency of lubrications and all additional required maintenance and frequency intervals.

E. SCADA System O&M Manuals

1. In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall submit their operation and maintenance manuals to the SCADA System Integrator (Curry Controls or Revere) for this Project on CD's in Corel WordPerfect (latest version), Microsoft Word (latest version), or text, "txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required).
2. The SCADA System Integrator shall be responsible to configure and compile the O&M Manuals into "hypertext" window help files and pdf files for use as computer "on-line" help screens for equipment operation and maintenance. The SCADA System Integrator shall return all files to the equipment and product manufacturer's for review and approval prior to introducing them into the SCADA System.

1.05 DOCUMENTATION AND MANUFACTURER'S SERVICES

A. The horizontal split-case pump manufacturer shall provide full documentation for all hardware, components, and equipment, including complete manuals for installation, operation, calibration, troubleshooting. All documentation shall be neatly organized, readable and complete.

B. Complete hardware installation, operation, maintenance and troubleshooting manuals shall be provided in accordance with Section 01650 and 01700.

C. Operation and maintenance manuals shall be prepared specifically for this Project, and shall include all required cut sheets, drawings, equipment lists, descriptions, safety requirements, special handling practices, etc., which are required to instruct operators and maintenance personnel on the proper operation and maintenance of these systems.

D. The manufacturer of the high service pumps shall provide the services of a factory-trained service representative to check and adjust the equipment and system when ready to be placed into operation. The manufacturer shall notify the County when the service representative will be at the project site. The serviceman shall train the County 's operator in the operation and maintenance of the equipment, inspect thoroughly for damage and missing items, check integral equipment supplied by other manufacturers, and make any necessary adjustments.

E. Conduct an operational test, under the observation of the County. Test shall demonstrate that the equipment and work is not defective and is in a safe and satisfactory operating condition.

F. A factory representative of the horizontal split-case pump manufacturer, who has complete knowledge of the proper operation and maintenance requirements for that specific pumping system, shall be provided for a minimum total of four (4) hours to instruct representatives of the County on proper operation and maintenance of the pumping systems. Training shall be organized, well structured and executed, so that

the treatment facility staff is well qualified and confident to operate these systems. The training is to be conducted in two separate presentations as not all the staff are able to be present at once. This four (4) hour training allowance is in addition to the eight (8) hours required for inspection of the installed equipment and the four (4) hour system start-up.

G. If there are difficulties in the operation of the equipment, due to the inadequate level of training or the manufacturer's design or fabrication, additional training and/or services shall be provided to resolve the difficulties, at no additional cost to the County.

H. Training sessions shall be scheduled at the convenience of the County, so that the appropriate personnel can be available. All training shall be video-taped, on DVD format, by the Contractor and DVD's shall be turned over to the County for future use.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The split-case horizontal pumps and related equipment and accessories shall be factory assembled and tested, and shall be delivered to the site for installation. Deliver a complete system ready to install as job progress requires.

B. All parts and equipment shall be properly protected, in a weathertight building, so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the units and equipment are ready for operation. Protect the equipment from being contaminated by dust, vibration and moisture.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the County. Pumps shall be prepared for shipment in accordance with API Standard 610.

D. Exposed openings for connection to piping shall be properly plugged or protected by wooden blanks, etc., strongly built and securely bolted to the flanged surfaces.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

F. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.

G. Each box or package shall be properly marked to show its net weight in addition to its contents.

H. The Contractor shall handle the equipment during delivery, storage and installation in a manner to prevent damage of any nature in accordance with the manufacturer's approved written instructions and in accordance with instructions given on-site by the manufacturer's representative.

1.07 WARRANTY AND GUARANTEES

A. All equipment supplied under this section shall be warranted for a period of two (2) years by the manufacturer. The warranty period shall commence upon Final Project Acceptance by the County. The Contractor shall refer the County's requirements for "Warranties and Bonds", for additional requirements.

B. The equipment shall be under warranty to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the County.

C. The replacement or repair, including the cost of parts and labor, of those items normally consumed in service, such as pump packing, oil, grease, and the like, shall be considered as part of routine preventive maintenance by the County.

D. Certifications
   1. Furnish certifications as specified in Section 01650, "Pump Station Start-up and Testing". Furnish the Engineer with a written certification signed by the manufacturer's representative, that the installed equipment:
      a. Has been installed per manufacturer's requirements.
      b. Has been lubricated per manufacturer's instructions
      c. Has been accurately aligned and proper running clearances set.
      d. Is free from undue stress imposed by piping or mounting bolts.
      e. Suction lines and seal water lines have been flushed and all debris removed prior to startup.
      f. Is ready to be operated on a continuous basis, and is free from any known defects.

PART 2 - PRODUCTS

2.01 EQUIPMENT GENERAL REQUIREMENT'S

A. All pump curves shall have no more than one specific flow rate corresponding to one specific head condition except for shut-off head.

B. Pumps and all related equipment shall be constructed of materials suitable for the intended applications.

C. Piping and fittings shall be ductile iron with flanges and shall conform to the requirements of the Contract Documents.

D. Data Plates
   1. All data plates shall be of stainless steel suitably attached to the pump with stainless steel screws. Pump data plates shall contain the manufacturer's name, serial number, pump size and type, speed, impeller diameter, design capacity and head, and other pertinent data.
   2. Motor data plates shall contain the manufacturer's name and model number, serial number, rpm, hp, frequency, voltage, phase, efficiency, and service factor.

3. A special data plate shall be attached to the pump frame which shall contain identification of the frame and bearing numbers.

E. Hardware
1. All machine bolts, nuts, and cap screws shall be of the hex head type and shall be non-corrosive.
2. Hardware requiring special tools or wrenches shall not be used.

F. Parts Numbering
1. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking.
2. Each part shall be properly identified by a separate number and those parts that are identical for more than one size unit shall have the same number to effect minimum spare parts inventory.

G. Miscellaneous Parts
1. The equipment shall be furnished with shims, stainless steel anchor bolts, couplings, sheaves, belts, motor flanges, drive and belt guards and any other miscellaneous materials necessary to properly mount and install the pumps and motors.

H. Painting
1. All external parts of the pump, motor, drive unit, base, and accessories shall be primed and finish painted (1 coat) at the factory prior to shipping.
2. Surface preparation, priming, and finish coating shall be in accordance with Section 09900 Painting.
3. All coatings used for shop painting shall be the products of the same manufacturer as the coating to be used for field painting to assure coating compatibility of the systems. The color of the finish coating shall be selected by the County.

2.02 HORIZONTAL SPLIT-CASE PUMPS

A. Furnish and install two (2) horizontal split-case pumps. Pumps shall be of the horizontal, lubricated single stage, double suction, axially split-case centrifugal pump type.

B. Suction and discharge nozzles shall be cast, bore and machined integrally with the lower half casing.

C. Potable Water Booster Pumps
1. Each pump shall be capable of the characteristics specified below and shall meet all governing agency requirements for the type of pumping system identified and shall be capable of pumping from the location and in the configuration shown on the Contract Drawings at designed capacities as noted:

INTERNATIONAL DRIVE POTABLE WATER BOOSTER PUMP STATION

Item	Pumps 2 & 3
Pumps Required	2
Design Point Capacity (gpm)	4000
Design TDH (ft)	70
Minimum Efficiency at Design Point (%)	88%
Shutoff Head (ft)	94.5
Required NPSH (ft)	
Suction Pressure	Positive
Liquid Handled	Potable Water
Max. Motor Horsepower (hp)	100
Max. Speed (rpm)	1180
Voltage (V)	460
Phase	3
Frequency (Hz)	60
Motor Type	Variable Speed
Approved Manufacturer & Model	Aurora (410 1 Stage Split Case, 10x12x15B), or equal

D. Pump Construction

1. Acceptable Manufacturer's for this Project shall be per Orange County approved list of manufacturers.
2. Pumps shall be single stage, double suction pumps with packed seals for water at ambient temperature.
3. Casing
   a. The casing shall be close-grained cast iron for working pressures up to 175 psig and shall be of the double volute, axially split design with suction and discharge flanges and mounting feet cast integrally with the lower half casing.
   b. Tapered and plugged holes shall be provided for priming, drain and gauge connections for the suction and discharge sides of pump.
   c. The upper and lower half casings shall be doweled and bolted together and the upper half removable without disturbing the suction or discharge piping.
4. Casing Connections

a. Flanges shall be of the 125 pound ANSI Standard B 16.1 type.
b. Suction and discharge shall be on a common centerline in the horizontal plane.
c. A ½-inch tap for a pressure gauge shall be provided on both flanges.

5. Internally drilled liquid passage in the upper half casing shall provide lubrication to the packing area.
6. Impeller
   a. Impeller shall be of the enclosed, double suction type made of one-piece cast bronze non-overloading in operating characteristics and statically and hydraulically balanced.
   b. The impeller shall be accurately machined and balanced to minimize thrust and shall be keyed to the shaft and positioned axially by the threaded shaft sleeves which are, in turn, locked in place by shaft nuts.
   c. The hub shall have sufficient metal thickness to allow machining for installation of impeller rings.
   d. The maximum diameter shall be less than ninety percent (90%) of the shaft to casing lip distance for quiet operation.
7. Shaft
   a. The shaft shall be made of SAE-4140 high grade carbon steel of ample size to operate under load with a minimum of deflection.
   b. The pump manufacturer shall furnish and publish a two (2) year warranty on shaft breakage.
8. Shaft Sleeves
   a. Shaft sleeves shall be made of 416 stainless steel, and shall protect the shaft from wear and from contact with the pumped liquid.
   b. The shaft shall be protected by renewable shaft sleeves that are threaded and tightened with shaft rotation and are free to expand at the stuffing box end.
9. Housing
   a. Seal housings and bearing housings shall be cast integral with the pump casing.
   b. Mechanical seals shall be mounted on a corrosion-resistant shaft sleeve, located with respect to the casing so that seal lubrication liquid is directed immediately over the seal.
10. Casing Wear Rings
    a. Casing wear rings shall be made of bronze and shall be installed with an anti-rotation device and designed to prevent leakage across the ring fit.
    b. There shall be not less than fifty (50) points Brinell hardness between the casing wear rings and the impeller wear rings.
11. Impeller Wear Rings
    a. Impeller wear rings shall be made of bronze and mounted on the impeller hubs to provide for renewable clearances.
12. Bearings
    a. Bearings shall be grease lubricated.
    b. Bearings shall be ball type, single row or double row, selected to carry radial and thrust loads and shall have a minimum L-10 bearing life rating or ten (10) years in continuous operation at the rated pump conditions.

c. The outboard bearing shall be a double row bearing, locked in position by bearing lock nuts.
d. The inboard bearing shall be a single row bearing, free to move axially in the bearing housing.
e. Labyrinth type deflectors shall seal the bearing housings against dirt and moisture.
f. Removable bearing caps and bearing covers shall permit inspection or service of the bearings without disturbing the pump casing or piping.
g. Bearing housings shall be designed for grease lubrication. Grease relief shall prevent over-lubrication.

13. Miscellaneous
a. Each pump shall be provided with single inside unbalanced mechanical shaft seals for leak-less operation.
b. A suitable arrangement shall be provided to furnish a portion of the pumped liquid to lubricate and cool the seal faces. Seals shall be suitable for the conditions stated.
c. A heavy fabricated steel base with drip lip and grout openings to mount the pump and driver shall be furnished with each pump.
d. A flexible shaft coupling shall be furnished to connect the driver to the pump.
e. The coupling shall be enclosed in a standard coupling guard.

E. Baseplate, Coupling and Guard
1. The baseplate shall be heavy-duty fabricated steel sufficiently rigid to support each pump and driver. The final alignment of the pump and driver shall be made after grouting and installation, and shall be approved by the Engineer prior to operation. It shall be of the drain type with a tapped hole to pipe away leakage and condensation.
2. The coupling shall be a heavy duty flexible type with cast iron flanges connected by a rubber sleeve for torque transmission.
3. The coupling guard shall be all metal, ANSI type, and fastened to the baseplate and in accordance with OSHA Standards.

F. Rotation
1. Clockwise rotation, viewed from its drive end, shall be provided based on the orientation shown on the Contract Drawings.

G. Motor
1. The pump manufacturer shall be responsible for supplying the motor and ensure proper coordination for mounting of the motor on the pump. Manufacturer shall properly select and size the drive unit (VFD) for the pump, inclusive of thrust bearing capacity for all conditions as start-up, runout, and shutoff. Motors shall meet the requirements of Section 16370, “Variable Frequency Drives”, unless otherwise specified herein.
2. The drive motor for the pump shall be of the NEMA Design B squirrel cage induction type, drip-proof, designed for operation on 460 volt, 3-phase, 60 Hertz power supply with a maximum speed of 1780 rpm for the potable water pumps. The motor shall be designed for use with a VFD and shall be Inverter Duty Rated.

3. Motors to have internal heat strips. Motor size shall be sufficient to prevent overloading at operating conditions or at the lowest listed head conditions, whichever point requires greater horsepower. Motors to include temperature sensors in the windings for overload protection. There shall be space heaters on the motors.
4. The pump motor shall be suitable for operation on a power supply as specified in Section 2.02(C) with a service factor of 1.00 or greater. The pump manufacturer shall approve the VFD to be used with the pumps. See Section 16370 "Variable Frequency Drives" for approved manufacturers.
5. The motor shall be premium efficiency, non-overloading, without use of the service factor, at any point on the driven pump's performance curve. The motor shall be standard tropicalized and shall be designed, constructed and tested in accordance with applicable IEEE, NEMA, AFBMA and ANSI standards as manufactured by U.S. Electrical Motors, or an equal approved by the County.
6. Following installation, grouting and connection of all piping, pump and motor must be checked for alignment in accord with standards of the Hydraulic Institute.
7. Motors shall be given a short commercial test in accordance with IEEE standards and furnished with the following construction features:

Feature	Description
1. Construction	All cast iron construction for the frame, end brackets, conduit box and fan shroud. The motor shall be supplied with lifting lugs or "O" type bolts on the top of the motor.
2. Enclosure	NEMA 4X, with a dynamically balanced fan and 120V operated space heaters
3. Motor Type	Variable Frequency Drive (see Specification Section 16370)
4. Horsepower	100
5. Efficiency	Premium, 88% at rated capacity, suitable for meeting Duke Energy minimum requirements for motor efficiency credit
6. Insulation	Class F
7. Temperature Rise	Class B, based upon 40°C ambient
8. Service Factor	1.15 with alternate rating of 1.0 for VFD controlled pump
9. Windings	Epoxy coated rotor and stator windings
10. Motor	Motor windings for rotor, stator and motor leads shall be manufactured using solid copper wire.

Feature	Description
Windings	
10. Shaft Slinger	Neoprene shaft slinger shall be provided and lead wires shall be non-braided and non-wicking to prevent entrance of moisture and contaminants.
11. Conduit Box	Cast iron construction and sized at 150% of the NEMA minimum
12. Terminal Box	All leads shall be brought out to a separate terminal box and shall be marked and identified. The terminal box shall be split construction, double gasketed, containing provisions for grounding the motor and shall have a volume of 150% of the NEMA minimum.
13. Breather Drains	Motors shall have stainless steel breather drains at both ends to allow proper drainage of condensation
14. Ball Bearings	Shielded, regreasable, vacuum degassed steel ball bearings. Minimum B-10 bearing life of 100,000 hours.
15. Hardware	Corrosion resistant hardware, insect screens and grease plugs
16. Gaskets	a. Gasket between the motor frame and conduit box b. Gasketed cast iron conduit box
17. Accessories	a. Each motor shall be provided with a heat overload protection device to protect the motor from overheating during operation. The device shall immediately stop the drive motor in the event of excessive heat buildup. b. The motor shall be provided with a 120 volt single phase strip heater to maintain a motor temperature of at least 40°C or 10 °C above ambient, whichever is greater.

H. Spare Parts

1. Furnish for each pump, the recommended spare parts, properly boxed and labeled for each pump, which are to include, as a minimum, the following:
   a. Two (2) sets of gaskets and O-rings.
   b. Two (2) mechanical seals.
   c. Two (2) sets of shaft sleeves, keys, and accessories.
   d. One (1) year supply of each type of lubricant required

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of pumping equipment shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Contract Drawings. Equipment shall be installed by experienced and mechanically skilled workmen with previous experience in similar installations. The Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

B. Install pressure gauges on the pump suction and discharge nozzles including an isolation valve at each location.

C. All anchor bolts, nuts, washers, brackets, and other hardware items shall be Type 316 stainless steel.

D. Conduct cement grouting of pump base in accordance with Appendix G, Precision Cementitious Grouting of API Standard 610.

E. All necessary piping, fittings, conduit, valves, air relief valves, air and vacuum valves, vents, concrete foundation, anchor bolts, supports, grouting, etc. shall be provided to ensure a complete and satisfactory installation of the pumping equipment.

F. Align the pump and motor in accordance with the manufacturer's instructions, except angular alignment (coupling face) shall be within 0.001 inch at outermost point on coupling and parallel alignment (coupling runout) shall be within 0.001 inch per inch of shaft diameter, unless otherwise directed by the equipment (pump and motor) manufacturer's instructions. No more than two shims of proper thickness shall be used to secure proper alignment. Prior to placing the pump in operation, recheck the alignment after piping and other external connections have been made up to the pump, and after the pump base has been grouted. Adjust and realign as required if alignment has changed. All alignments and adjustments made to the pump shall be by technicians with prior experience and training in making such alignments and adjustments for the specific equipment provided.

G. Noise and Vibrations

1. All equipment containing moving parts shall be installed level and plumb, unless otherwise indicated in the Contract Drawings or in the specifications, and shall be anchored securely in order that noise be suppressed to a minimum and that vibrations do not cause damage while in operation.

3.02 FACTORY SERVICE REPRESENTATIVE

A. The equipment manufacturer shall furnish the services of a competent and experienced representative who has complete knowledge of proper operation and maintenance of the equipment for a period of not less than two (2) eight (8) hour days in two separate visits to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed. The second visit will be to operate and supervise the initial field test. At least four (4) hours of the second day shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. The training is to be conducted in two separate presentations as not all the staff are able to be present at once. This instruction period shall be scheduled at least ten (10) days in advance with the County and shall take place prior to acceptance by the County. The final copies of Operation and Maintenance manuals specified in this section and in Section 01700 must have been delivered to the County prior to scheduling the instruction period with the County.

B. The duties of the service representative shall be as follows:

1. After the equipment has been installed but before it is operated by others, the representative shall inspect the completed installation for soundness (no damaged or cracked components), completeness, correctness of setting and alignment, that the pumps are free from stresses imposed by attached piping, and for the adequacy and correctness of mechanical seal alignment and lubricants.
2. The service representative shall start-up the equipment. All pumps shall be tested with their respective driver or with a test driver (in such case, complete performance characteristics of the motor shall also be provided). This data shall include, but not be limited to, voltage, speed, current, horsepower, power factor, etc., in accordance with the latest Standards of the Hydraulic Institute. Certified test results shall contain at least the following items: 1) Head-capacity curve, 2) pump efficiency, 3) brake horsepower from 0 gpm to 130 percent of design capacity, and 4) overall efficiency, wire to water.
3. All of this information shall be obtained in accordance with the recommended procedures of the Hydraulic Institute. These certified test results shall be furnished in triplicate to the County. If, upon completion of the tests, the results indicate the specified performance is not obtained, the pump shall be considered as having failed to fulfill the requirements.
4. The service representative shall instruct the County's personnel in proper operation and maintenance procedures.
5. The responsibility of the Contractor with regards to start up shall be fulfilled when the startup is complete, the equipment is functioning properly and has been accepted by the County.

C. The service representative shall submit to the County six (6) copies of a signed report of the result of his inspection, adjustments and startup. The report shall include descriptions of the inspection, adjustments made, and the startup. The report shall also include a statement that the equipment is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void. Final payment shall not be made to the Contractor until this report has been submitted to and approved by the County.

3.03 INSPECTION AND TESTING

A. After the pumps have been completely installed, the service representative and Contractor shall conduct, in the presence of the County, field testing of all mechanical equipment and piping as in operation to demonstrate discharge capacity, pump efficiency, correct alignment, smooth operation, proper adjustment, and freedom from noise, vibration, over-heating and leaking, and to ensure satisfactory compliance with the Specifications. All defects shall be corrected. The Contractor shall supply all oil, grease, electric power, water, and all other material necessary to complete the field tests.

B. If the pump performance does not meet the Specifications, corrective measures shall be taken by the Contractor, or pump shall be removed and replaced with a pump which satisfies the conditions specified.

C. Motor Field Testing
   1. The motor shall be disconnected from the pump and run for four (4) hours.
   2. Following the run-in test, reconnect the motor to the pumping equipment and reinstall all coupling guards.

D. Pump Field Testing
   1. Upon completion of all the mechanical work, the service representative and Contractor shall conduct testing as specified herein to demonstrate that the equipment performs in accordance with all Specifications.
   2. The Contractor shall perform initial testing of the equipment to ensure himself that the tests listed in the Demonstration Test paragraph below can be completed.
   3. The Demonstration Test shall demonstrate that all items of these Specifications have been met by the equipment, as installed, and shall include the following tests:
      a. That the pump can deliver the specified pressure and discharge flow at rated efficiency.
      b. That the pump controls perform satisfactorily.
   4. In the event that the equipment does not meet the Demonstration Test, the Contractor shall, at his own expense, make sure changes and adjustments in the equipment which he deems necessary and shall conduct further tests until written certification is received from the Engineer.

E. All piping, fittings and valves shall be hydrostatically tested in accordance with Section 02660, "Potable Water Systems."

3.04 PUMP CURVES

A. Submit to the County, in accordance with Section 01300, "Submittals", six (6) copies of the ***certified*** pump performance curve for each pump.

B. The pump curve shall indicate the pump number, type of service, manufacturer, model number, serial number, location in the plant and other data specific to the pump as required above for submittals.

3.05 MAINTENANCE CARDS

A. Submit to the County six (6) copies of the maintenance requirements for each pump, 8½" x 11" in size, for approval by the County at least thirty (30) days prior to the startup of the pumps.

B. After approval of the maintenance cards, the Contractor shall submit to the County six (6) copies of the maintenance requirements for each pump, 8½" x 11" in size, laminated in plastic.

END OF SECTION

SECTION 11226

STATIC INJECTION MIXERS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of wafer style in-line static injection mixers for chemical injection into pressurized pipelines.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Potable Water System: 02660.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01300.

B. Submit dimensional drawings and installation details. Submit manufacturer's catalog data and descriptive literature, describing materials of construction by ASTM reference and grade.

C. Show material of construction, with ASTM reference and grade. Submit manufacturer's certificates of compliance with referenced standards, e.g., ASTM A312 and A778. Show thickness of steel shell.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Mixers shall be as manufactured by Westfall, Komax, or equal.

2.02 MIXER DESIGN

A. The mixers shall be of a compact ring body design for mounting between two standard pipe flanges. The ring body shall be a minimum thickness of 0.875 inches and shall be fabricated from Beta PVC or other material inert to sodium hypochloride solution.

B. The mixer plate shall be designed to provide a geometric shape which will create mixing vortices to effectively mix the injected fluid with the main process fluid. The mixing plate shall be no less than 0.125 inches thick and formed from .8 Beta PVC or Kynar. The mixer plate shall be mounted in a machined cavity on the upstream side of the ring body. The body shall include one or more injection fittings. The mixer body and plate materials shall be suitable for handling potable water as the process fluid at the rate of 12,000 gpm and 30 psi. The injection fluid is 12.5% sodium hypochlorite and may be added in the future.

PART 3 – EXECUTION

3.01 EQUIPMENT INSTALLATION

Install static mixer per manufacturer's instructions.

END OF SECTION

SECTION 11304
SUMP PUMP

PART 1 - GENERAL

1.01 DESCRIPTION

The contractor shall provide labor, material, equipment, and incidentals required to provide the centrifugal sump pump as specified herein.

1.02 SUBMITTALS

A. Submit in accordance with Section 01300 Submittals

B. Manufacturer's Literature and Data:
   1. Manufacturer and model.
   2. Operating speed.
   3. Capacity.
   4. Characteristic performance curves.
   5. Efficiency.

C. Certified copies of all the factory and construction site test data sheets and reports.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

PART 2 - PRODUCTS

2.01 SUMP PUMP

A. Centrifugal submersible pump and motor, designed for 140 degrees F maximum water service. Driver shall be electric motor. Support shall be rigid type. Provide perforated, suction strainer. System includes one pump. Pump shall be capable of continuous duty cycle, 25 gpm flow at 19 feet total head.

B. Pump housings may be cast iron, bronze, aluminum, plastic or stainless steel. Cast iron and aluminum housings for submersible pumps shall be epoxy coated.

C. Impeller: Brass, bronze or cast iron.

D. Shaft: Stainless steel or other approved corrosion-resisting metal.

E. Bearings: As required to hold shaft alignment, anti-friction type for thrust permanently lubricated.

F. Motor: Maximum 104 degrees F ambient temperature rise above the maximum fluid temperature being pumped. Motor shall be completely enclosed, oil-filled 120 V single phase conforming to NEMA 250 Type 6P. Size the motor capacity to operate pump without

overloading the motor at any point on the pump curve. Motor shall be a minimum ½ horsepower.

G. The submersible pump shall be supplied with 25 feet of power cable. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity to eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

G. Automatic Control:
   1. Provide high water level ON and low water level OFF float type switches.

I. Provide a check and ball valve in the pump discharge line.

PART 3 - EXECUTION

3.01 STARTUP AND TESTING

A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements.

B. The tests shall include system capacity and all control functions.

C. When any defects are detected, correct defects and repeat test.

D. The County will observe startup and Contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the County. Provide a minimum of 7 days prior to notice.

END OF SECTION

SECTION 13300

PROCESS INSTRUMENTATION AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work includes engineering, furnishing, installing, testing, documenting and placing in operation a Pump Control Panel (PCP) and associated field instruments at Orange County, Florida's International Drive Potable Water Re-Pump Station.

B. The PCP shall contain a Programmable Logic controller (PLC) that provides monitoring and control functions for the station.

C. The PLC shall be integrated into the existing County Supervisory Control and Data Acquisition (SCADA) system by others. Co-ordinate closely with the supplier of Work under Specification Section 13330 (e.g. IP address assignments) to ensure optimum integration of the PCP into the SCADA system.

D. Work includes development of screens and programming at the County's Eastern Water Facility.

E. It is the ultimate responsibility of the CONTRACTOR to furnish a complete and fully operable PCP that reliably performs the specified functions. However, it is the intent of these Contract Documents that a single entity (henceforth referred to as the SYSTEM SUPPLIER) be retained by the CONTRACTOR to have overall responsibility for designing, furnishing, interfacing, adjusting, testing, documenting, and starting-up the PCP equipment described in the Contract Documents.

F. The work defined in this Specification Section shall be performed by the following listed below and henceforth referred to as the SYSTEM SUPPLIER.

1. Curry Controls, Lakeland, Florida
2. Revere Control Systems
3. Electro Design

The CONTRACTOR shall be responsible for:

1. Equipment storage and protection until installed following the storage and handling instructions recommended by the SYSTEM SUPPLIER. Anti-static and winterization requirements shall be per the SYSTEM SUPPLIER's instructions and the SYSTEM SUPPLIER shall periodically verify that these instructions are followed.

2. Including within the electrical subcontractor's scope the provision, installation and termination of field and power wiring to the PCP. Termination shall be made in accordance with final accepted interconnection diagrams developed by the SYSTEM SUPPLIER. The electrical subcontractor shall mark on the interconnect diagram the field wire numbers

used for each termination point. The SYSTEM SUPPLIER shall finalize the interconnect diagrams by including these field wire numbers in the final as built version.

2. Physical installation of the PCP. The CONTRACTOR shall require the SYSTEM SUPPLIER to observe and advise on the installation of the PCP to the extent required to certify, with the operational check-out tests, that the equipment will perform as required.

G. All engineering development required by the SYSTEM SUPPLIER will be in accordance with the Conditions of this Contract.

H. Equipment found to be defective prior to system acceptance shall be replaced and installed at no additional cost to the OWNER.

I. In the bid price, the SYSTEM SUPPLIER shall provide for obtaining the services of authorized field personnel from the manufacturers of components or systems provided under this section but not manufactured by the SYSTEM SUPPLIER. Should these personnel be required during installation, start-up and checkout of the PCP, such services shall be provided at no additional cost to the OWNER.

1.02 RELATED WORK

A. Specification Section 13330 defines requirements associated with incorporating the PCP into the OWNER's existing SCADA system.

B. All conduits, power and field wiring and cables are provided and installed under Division 16.

1.03 SUBMITTALS

A. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section and its associated sections of the work.

B. Submit complete, neat, orderly, and indexed submittal packages. Handwritten diagrams are not acceptable and all documentation submittals shall be made using CADD generated utilities.

C. Partial submittals or submittals that do not contain sufficient information for complete review or are unclear will not be reviewed and will be returned by the ENGINEER as not approved.

D. Provide all shop drawing submittals on disk in PDF format.

E. Submit the following Field Instrumentation Shop Drawings in a single package:

1. Catalog information, descriptive literature, wiring diagrams, and shop drawings on all components of the field instruments, including all miscellaneous electrical and mechanical devices furnished under this section.

2. Complete part numbers for all instruments, including any options, shall be identified. Provide manufacturer's data that correlates to the complete part number.

3. Individual data sheets for all components of the field instruments to supplement the above information by citing all specific features for each specific component (e.g. scale range, materials of construction, special options included, etc.). Each component data sheet shall bear the component name and instrument tag number designation shown in the Drawings and Specifications.

4. Installation details for all field mounted devices to show conformance with the Contract Documents.

5. Configuration documentation for all programmable devices to indicate actual settings used to set the device scale, range, trip points, and other control parameters.

F. Provide a single PCP shop drawing submittal containing the following:

1. Loop diagrams, consisting of complete wiring and/or plumbing diagrams for each control loop showing all terminal numbers, the location of the dc power supply, the location of any booster relays or common dropping resistors, surge arrestors, etc. The loop diagrams shall meet the minimum requirements of ISA S5.4 plus divide each loop diagram into four areas for identification of element locations: PLC I/O point(s), panel face, back-of-panel, and field, respectively.

2. System interconnect diagram that shows all connections required between component parts of the items covered in this section and between the various other systems specified in this Contract. Number all electrical terminal blocks and field wiring. Identify each line at each termination point with the same number. Do not use this number again for any other purpose in the complete control scheme.

3. Proposed graphics/screens

4. Bill of Materials: A list of all components, including all 3rd party software. Group components by type and include component model number and part number, component description, quantity supplied, and reference to component catalog information.

5. Descriptive Information: Catalog information, descriptive literature, performance specifications, internal wiring diagrams, power and grounding requirements, power consumption, and heat dissipation of all elements. Clearly mark all options and features proposed for this project.

6. Installation Details. Equipment installation drawings showing external dimensions, enclosure material and spacing, mounting connections, and installation requirements.

7. A list of, and descriptive literature for, spares, expendables, and test equipment.

G. Test Procedures: Submit the procedures proposed to be followed during all system testing. Procedures shall include test descriptions, forms, and check lists to be used to control and document the required tests.

H. Test Reports: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures to the ENGINEER.

1.04 FINAL DOCUMENTATION

A. After the demonstration tests have been completed and as a part of the final acceptance requirements, submit the PCP record drawings. Record drawings shall include, corrected for any changes that may have been made up through Substantial Completion:

1. instrument loop wiring diagrams

2. panel wiring diagrams

3. panel elevations

4. interconnection diagrams showing terminal numbers at each wiring termination

B. Record drawings shall be developed or converted to the latest version of AutoCAD. Provide two copies of all AutoCAD files on separate Compact Disks.

C. Operating and Maintenance (O&M) Manuals: Provide the specified number of complete sets of three-ring bound O&M manuals in accordance with Division 1. Include descriptive material, drawings, and figures bound in appropriate places. Include:

1. Cross references to 3rd party O&M manuals.

2. Additional operating and maintenance instructions in sufficient detail to facilitate the operation, removal, installation, adjustment, calibration and maintenance of each component provided with the PCP.

3. All the submittal data for each component from the approved shop drawing submittals with corrections made on approved as noted items.

4. A Compact Disk containing the shop drawing data in PDF format in the binder sleeve.

D. Provide the following additional final documentation:

1. Licenses in the OWNER's name for all software supplied including software used for programming.

2. Final copies of all programming files on Compact Disk

1.05 QUALITY CONTROL

A. The SYSTEM SUPPLIER shall be subcontracted by and paid by the CONTRACTOR.

B. The SYSTEM SUPPLIER shall meet all of the requirements of these specifications, and, unless specifically stated otherwise, no prior acceptance of any subsystem, equipment, or materials has been made.

C. All equipment furnished by the SYSTEM SUPPLIER shall be of the latest and most recent design and shall have overall accuracy as guaranteed by the manufacturer.

D. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

E. Component equipment shall be as supplied by one of the manufacturers named or approved equal. The design of the PCP is based on the first-named manufacturer's equipment if there is a difference.

F. To facilitate the OWNER's operation and maintenance, products shall be of the same major MANUFACTURER, with panel mounted devices of the same type and model as far as possible.

G. In order to insure the interchangeability of parts and the maintenance of quality, strict compliance with the above requirements shall be maintained.

H. The SYSTEM SUPPLIER shall designate a single point of contact for interface with the ENGINEER on this project. The ENGINEER reserves the sole right to approve or reject this point of contact.

I. The SYSTEM SUPPLIER shall provide experienced personnel on-site to coordinate and/or perform installation, termination, and adjustment; on-site testing; OWNER training; and startup assistance for the PCP.

1.06 STANDARDS

A. The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable state and local requirements. UL listing and labeling shall be adhered to under this Contract.

B. International Society of Automation (ISA) and National Electrical Manufacturers Association (NEMA) standards shall be used where applicable in the design of the PCP.

C. Any equipment that does not have a UL, FM CSA, or other approved testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment famished has been manufactured in accordance with the National Electric Code and OSHA requirements.

D. Any additional work needed resulting from any deviation from codes or local requirements shall be at no additional cost to the OWNER.

E. All instrumentation and controls for this project shall be in accordance with Orange County Standards, more specifically "I & C Design Criteria – dated January 19, 2007".

1.07 WARRANTY AND GUARANTEES

A. In accordance with Division 1, the SYSTEM SUPPLIER shall furnish to the OWNER a written two year guarantee commencing with substantial completion, that all equipment and parts thereof, material and/or workmanship are of top quality and free from defects.

B. The SYSTEM SUPPLIER shall guarantee all equipment whether or not of his own manufacture.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Equipment to be installed in a hazardous area shall meet Class, Group, and Division classification as shown on the Contract Electrical Drawings, or comply with the local or National Electrical Code, whichever is the most stringent requirement.

B. All instruments requiring plumbing shall utilize stainless steel components as follows:

1. Test Tap: Shall consist of Crawford Fitting Co. Swagelock quick connects Series QC4-DE, or equal.

2. Tubing, Stainless Steel: Shall be ASTM A 312, TP 316, seamless, soft annealed with 0.065 inch wall. Fittings shall be ASTM A 276, TP 316 compression or socket weld type.

3. Valve, Ball: Shall be stainless steel ball valves, Whitey Series 40, Hoke Flamite Series 7100, or equal.

C. All instrumentation supplied shall be of the MANUFACTURER's latest design and shall produce or be activated by signals, which are established standards for the water and wastewater industries.

D. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mA DC (milliampere direct current); however, signals between instruments within the same panel or cabinet may be 1-5 volts DC (direct current). Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed.

E. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks.

F. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent. Indicator readouts shall be linear in process units.

G. Electronic equipment shall utilize printed circuitry suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose, to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

H. All equipment shall be designed to operate on a 60-Hertz alternating current power source at a normal 120 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

I. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single MANUFACTURER, insofar as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion through the installation of plug-in circuit cards or additional cabinets.

J. The equipment furnished shall be designed to operate satisfactorily between 0 degrees C and 40 degrees C at up to 95 percent Relative Humidity (non-condensing).

K. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 volts-amperes (VA), unless specifically noted otherwise.

L. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

2.02 LIGHTNING/SURGE PROTECTION

A. Surge suppressors and arrestors meeting the requirements of ANSI Standard C-62.41 (latest revision) shall be provided as further detailed below.

B. DC signals. Lightning and surge protection shall be provided on all 4-20 mA signal wires entering or leaving the panel. The protectors shall meet the following criteria:

1. 35 mm DIN rail mounted.

2. Response time of less than five nanoseconds.

3. Automatic reset.

4. Operating signal voltage: up to 30 Volts DC

5. Operating signal current: up to 150 mA

6. Capable of withstanding 1,200 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.

7. Capable of withstanding 100 Amps at IEEE/ANSI C-62.41 10 x 1 milliseconds long wave.

8. Nominal series resistance of 5 ohms each leg

9. Manufacturer/model:

   a. MTL Series SD32X

   b. EDCO DRS-036

   c. Phoenix Contact

C. Single phase AC Power (to 15Amps). Lightning and surge protectors for AC power supply lines up to 15 Amps service shall meet the following criteria:

1. Serial protection with replaceable fuse.

2. Failure indicator

3. Response time of less than five nanoseconds.

4. Capable of withstanding up to 10,000 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.

5. Manufacturer/model:

   a. EDCO HSP121BT

   b. MTL Series MA15

   c. Phoenix Contact

D. Single phase AC Power (over 15Amps). Lightning and surge protectors for AC power supply lines over 15 Amps service shall meet the following criteria:

1. Parallel protection using MOVs and thermal fusing technology.

2. Failure indicator

3. Response time of less than five nanoseconds.

4. Capable of withstanding up to 6,500 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.

5. Manufacturer/model:

   a. EDCO FAS-120AC

   b. MTL

c. Phoenix Contact

E. AC Powered Instruments. Lightning and surge protection shall be provided on both the AC power supply and signal lines. The protectors and the instrument/transmitter shall be mounted in a NEMA 3R Stainless Steel vented enclosure with three point latch. The protectors shall meet the following criteria:

1. NEMA 4X small case, conduit mounted enclosure.

2. Response time of less than five nanoseconds.

3. AC Power protection: IEEE/ANSI Std. C-62.41 rated C3 at 330 Volts clamping level.

4. Signal line protection: 10,000 Amp 8 x 20 microsecond surge, clamped at 36 Volts clamping level.

5. Test jacks for low level signal monitoring.

6. Manufacturer/model:

a. EDCO SLAC series.

b. MTL SDX150 and SD32X

c. Phoenix Contact

F. Loop Powered Instruments. Lightning and surge protection shall be provided on the 4-20 mA DC signal line. The protectors shall meet the following criteria:

1. Encapsulated in Stainless Steel Pipe nipples for in-line conduit mounting.

2. Response time of less than one nanosecond.

3. Capable of withstanding up to 400 occurrences of 500 Amps at 10 x 1 millisecond.

4. Series resistance of 5 ohms per line.

5. Protection of both lines plus shield.

6. Manufacturer/model: EDCO SS65, MTL or Phoenix Contact

G. All discrete input and output signals that connect to instruments or equipment outside the electrical building housing the PCP shall be equipped with interposing relays to electrically isolate them from the control system I/O. Discrete output interposing relays shall each be equipped with a snubber circuit across the coil.

2.03 PROGRAMMABLE LOGIC CONTROLLER

A. Monitoring and control of the site shall be accomplished within the PLC. All control strategies specified in Part 3 of this Specification Section shall be implemented within the PLC.

B. The design is based on the use of Non-Unity Modicon Quantum series components. For conformance with OWNER standards, no other PLC manufacturer or model shall be acceptable.

C. All PLC modules shall be housed in DIN-rail mounted chassis'. Input/Output (I/O) modules shall be mounted in one or more dedicated remote I/O chassis'. The chassis shall be sized as follows:

1. Use six, ten, or sixteen slot racks, Modicon 140XBP series, as required to accommodate the I/O requirements specified. If necessary, provide expansion chassis' to meet these requirements.

2. Install I/O modules sufficient to accommodate the I/O (including all identified future I/O) shown on the Contract Drawings plus 15% additional I/O points of each type within each rack.

3. Provide a minimum of two unpopulated slots with slot fillers.

D. Power Supply Module. Each I/O rack shall be equipped with its own regulated power supply module energized from a standard, commercial 120 VAC 60 Hz, single phase source provided by the Uninterruptible Power Supply specified elsewhere herein. Any power transformation, rectification, regulation, or other conditioning necessary shall be provided as part of the unit's power supply package. The module shall be sized as follows to handle the power requirements for a fully populated I/O chassis'.

E. CPU Module. Provide Modicon P/N 140CPU-434-12A or higher if necessary to accomplish the functional requirements of this Specification Section. The PLC, as installed, shall use a maximum of 50% memory.

F. Communications Modules. Provide the following communications modules as required to implement the complete PCP:

1. Ethernet Module. Provide Modicon P/N 140NOE-771-01,

G Process I/O modules. All I/O modules shall be provided with screw-type terminal blocks with barriers between adjacent terminals for connection of field wiring. Terminals shall be suitable for accepting up to and including No. 14 AWG wire. All terminal blocks shall be key coded to prevent connection to other I/O modules. The following modules shall be used:

1. Discrete inputs: Modicon model 140DAI-540-00.

2. Analog inputs: Modicon model 140ACI-030-00.

3. Discrete outputs: Modicon model 140DAO-840-00.

4. Analog outputs: Modicon model 140ACO-020--00.

2.04 OTHER CONTROL SYSTEM HARDWARE

A. Operator Interface Unit (OIU). The OIU shall be a 15-inch full color LCD touch-screen capable of interconnecting with the PLC via Modbus TCP/IP Ethernet. Provide Modicon P/N XBTGT7340 or approved equal.

B. Ethernet Switch. The ethernet switch shall interconnect the OIU, PLC, Variable Frequency Drives, Power Monitors, Generator control Panel and the OWNER's existing SCADA system. For consistency with other elements of the SCADA system the switch will be furnished by OWNER for installation by SYSTEM SUPPLIER in the PCP.

C. Firewall. The firewall shall interconnect ethernet switch and router. For consistency with other elements of the SCADA system the firewall (HIPSwitch) shall be TEMPERED NETWORKS

D. Router. The router shall interface the firewall with a T-1 telephone line provided by others for the link with the OWNER's existing SCADA system. For consistency with other elements of the SCADA system the router will be furnished by OWNER for installation by SYSTEM SUPPLIER in the PCP.

2.05 FIELD INSTRUMENTS

A. Electro-magnetic Flow Metering System (LP-6250). The magnetic flow metering system shall comprise a flow through spool piece with sensing electrodes (Flow Element, FE) and an electronics unit (Flow Indicating Transmitter, FIT). The spool piece shall contain a coil energized by d.c. pulses from the electronics unit. The voltage induced in the process fluid shall be sensed by the electrodes and converted, by the electronics unit, into a derived flow signal.

1. System Performance:

   a. Systems shall be wet calibrated at the factory using NIST traceable equipment.

   b. Overall system accuracy shall be plus or minus 0.5 percent of rate between 1 and 30 feet per second.

   c. It shall be possible to verify system calibration in the field. Methods which require removal of the spool piece or a second flow measurement (i.e. another meter or known volume) will not be acceptable.

2. Materials:

   a. Tube – Carbon Steel

   b. Liner – Neoprene rubber for clean water applications. All other applications shall be Teflon.

c. Flange –316 Stainless Steel ANSI 150#

d. Electrodes – 316 Stainless Steel.

3. Ratings:

a. Vault located spool piece – Rated for continual submergence to 10 feet. This shall include potting of the able between the spool piece and electronics unit.

b. Other spool pieces –NEMA 4X.

c. Electronics Unit – NEMA 4X

4. Electrical:

a. Power Requirement - 120 VAC plus or minimum 10 percent, 60 Hertz.

b. Maximum Power Consumption – 20 Watts.

5. Functional:

a. Programmable low flow cut-out

b. Empty pipe detection

c. Electronic unit display: minimum of 2 x 16 character, backlit LCD.

6. Options

a. Provide grounding rings and/or integral grounding electrodes as required to establish potential matching.

b. Provide ultrasonic cleaning where necessary for coating sensitive systems

c. Provide special tools and software necessary to effect field calibration

d. Provide certificate of factory calibration

6. Manufacturer, Model series:

a. Per Orange County Utilities – Appendix D- List of approved products.

B. Pressure Transducer (LP-6251, LP-6225). The pressure transducer shall sense variations in pressure and produce a standard current output signal linear with gage pressure (Pressure Indicating Transmitter, PIT), differential pressure (Differential Pressure Indicating Transmitter, DPIT), flow via square root extraction of differential (Flow Indicating Transmitter, FIT) or, via inference, level (Level Indicating Transmitter, LIT). The transducer shall use a diaphragm activated cell method to

monitor process pressure via impulse piping connected through a valve manifold and, where noted, diaphragm seals.

1. Performance:

    a. Total accuracy of less than or equal to 0.2% of span for +/- 50 degree temperature changes from 1:1 to 10:1 range down.

    b. Adjustable zero and span values anywhere within the nominal range.

    c. Differential transducers shall provide direct reading or integral square-root extraction.

2. Materials:

    a. Metallic Wetted parts – 316 Stainless Steel.

    b. Wetted O-rings – Glass filled TFE.

    c. Fill liquid - NSF approved for use in drinking water applications.

    d. Electronics Housing – Low copper aluminum with polyurethane paint.

    e. Mounting hardware – 316 Stainless Steel.

3. Ratings:

    a. Enclosure – NEMA 4X

4. Electrical:

    a. Transmitter excitation: 10.5 to 32 Volts DC at up to 18 mA.

5. Options:

    a. Provide surge/lightning protection within the transmitter.

    b. Provide 3-way SS valve manifold.

    c. Provide integral LCD indicator with displayed value in process units.

    d. Provide minimum half inch process connection.

6. Manufacturer, Model series:

    a. Rosemount, 3051 series.

    b. No equal.

C. Chlorine Analyzer (LP-6248). The chlorine analyzer shall employ an amperometric method of direct measurement of free chlorine residual without the need for buffers or reagents. The sensor shall be a three bare-electrode cell with built in flow control.

The analyzer shall be microprocessor-controlled and provide a 4-20 mA recorder output as well as 2 alarms. Power requirements shall be 115 Vac, 50/60 Hz 14 VA maximum.

1. System Performance

   a. Range: Adjustable, set to 0 to 5mg/L free residual chlorine, with automatic color/turbidity and pH compensation

   b. Accuracy: $\pm$ 2% full scale or 0.01 mg/L as Cl_2, whichever is greater

   c. Response Time: 20 seconds maximum for a 90% step change

   d. Operating temperature range: 5-50 degrees C.

2. Enclosure: NEMA 4X rated

3. Outputs:

   a. One 4-20 mA with an output span programmable over the selected range. 50V isolation from earth ground

      Additional 4-20 mA outputs for Ph and temperature shall be provided.

      Two alarms selectable for sample concentration, system warning or system shut-down. Each alarm is equipped with an SPDT relay with contacts rated for 5 A resistive load at 230 Vac.

4. Manufacturer/Model Series

   a. Tiernan Depolox 3 Plus

   b. No equal.

D. Pressure Switch (LP-6245, LP-6226). The pressure switch shall sense pressure variations by means of a diaphragm and operate a snap action switch when the pressure reaches an adjustable level. Pressure switches shall be equipped with diaphragm seals where shown on the drawings

1. Performance:

   a. Adjustable deadband between 5% and 50% of maximum range

   b. Automatic reset

   c. Dual SPDT contacts

   d. Setpoint and deadband adjustments visible from outside the enclosure

2. Materials:

a. Pressure Chamber Wetted parts – 316 Stainless Steel

3. Ratings:

a. NEMA 4X

4. Electrical:

a. Contacts rated 15 Amps at 120 V AC.

5. Manufacturer, Model series:

a. Mercoid, DAW 7041 series.

b. Approved equal

E. Limit Switch (LP-6298). The limit switch shall detect the closed position of a hatch, door, etc. by means of an actuator. The actuator shall energize the switch while the door is closed.

1. General:

a. Actuator orientation: As required for application

b. Actuator mechanism: Adjustable lever roller.

c. Switch shall not be mounted on the moving portion of the door or hatch.

2. Materials:

a. Normal applications: Phosphate coated zinc with Epoxy coating.

b. Corrosive locations: All 316 Stainless Steel including actuating lever.

3. Ratings:

a. NEMA 4X for normal applications.

b. NEMA 6 where potential submergence exists.

c. Use explosion proof switches with factory installed cable for all Class I rated locations.

4. Electrical:

a. Normally open and normally closed dry contacts

b. Dry contact rated to 10 Amps at 120 VAC

5. Options

a. Provide stainless steel supports/mounting and strike plates as required.

6. Manufacturer, model:

a. Honeywell, model HDLS or LSX as applicable

b. Approved equal.

F. Level Switch, Float. The level switch shall be a direct acting, weighted float suspended on its own cable. As the liquid level rises the float tilts and actuates a hermetically sealed mercury switch inside the float. The cable shall be terminated within a junction box located outside the tank or basin. For multiple float applications, all cables shall terminate in a single junction box.

1. Materials:

a. Float wetted part – Polypropylene

b. Cable – PVC jacketed

c. Junction box – 316 SS

2. Ratings:

a. Junction box – NEMA 4X

3. Electrical:

a. Dry contact rated to 4.5 Amps at 120 VAC

b. Normally open or normally closed as required for the application

4. Options

a. Provide stainless steel supports/mounting accessories as required.

5. Manufacturer, model:

a. Per Orange County Utilities – Appendix D- List of approved products.

G. Smoke Detector (LP-6299)

1. The smoke detector shall operate on the photoelectric light scattering principle and shall be listed by Underwriter's Laboratories, Inc. and the Bureau of Standards and Appeals.

2. The smoke detector shall contain an infrared LED light source and a light sensing photodiode. These components shall be positioned such that when smoke particles enter the sensing area, light from the LED reflects onto the

photodiode. When the amount of light reflected onto the photodiode reaches a predetermined level, the detector shall latch into alarm.

3. The smoke detector shall contain a test knob that, when in TEST 1 Position, scatters the detector's LED light source to the equivalent of a nominal .85% actual smoke condition, when in Test 2 position the detector shall simulate an equivalent of a nominal 3.5% actual smoke condition. Test feature shall indicate when maintenance is required without the need of additional equipment. A magnetic switch closure or other switch closure, or smoke generating equipment which does not scatter the light beam or test sensitivity is not sufficient.

4. The smoke detector shall be able to contain an optional internal 90dBA horn (at 10 feet) which emits an intermittent tone when the detector alarms. Also have the provision of reverse polarity operation. The horn shall have the capability of being self-restoring.

5. The smoke detector shall be able to provide a self-restoring integral/isolated heat sensor set to alarm at 135°F (57.2°C) fixed temperature.

6. The smoke detector shall be provided from the manufacturer with all internal wiring (power in, power out and alarm contacts have 2 wires, auxiliary relay contacts each have 1 wire) leading into a plug-in terminal socket for ease of field installation. The manufacturer shall further supply the field wiring harness with plug connector for connection to insulated wire connectors.

7. The smoke detector shall be listed for wall or ceiling mounting.

8. Electrical:

    a. Power Requirement: 24 VDC. Current consumption of 6mA standby, 60mA alarm.

    b. The smoke detector shall be provided with an auxiliary Form C dry relay contact for use as remote annunciation. Rated 1 Amp at 24 VDC.

9. Manufacturer/model:

    a. Gentex Model 8240

    b. Approved equal

2.06 CONTROL PANEL REQUIREMENTS

A. Provide a free-standing NEMA 12 enclosure housing the PLC equipment and related appurtenances as shown on the Contract Drawings and as specified herein.

B. General:

1. All conduit entry shall be from the bottom only.

2. The panel shall be provided with an isolated copper grounding bus to ground all signal shield connections.

3. The panel shall be equipped with an internal, hand-switch controlled, 40-watt fluorescent light and 120V, 15 amp, duplex utility receptacle. These shall be serviced through a dedicated breaker.

4. The panel shall be protected from internal corrosion by the use of corrosion – inhibiting vapor capsules. Provide:

   a. Northern Instruments Model Zerust VC-6-2

   b. Hoffman, model A-HC15E

   c. Approved equal.

C. Finish:

1. All front panel openings for panel-mounted equipment shall be cut with counter-boring and provided with trim strips as required to give a neat finished appearance.

2. All steel panel surfaces shall be treated with phosphatized treatment inside and out, and then finished on the exterior with two coats of baked enamel of the approved color. Interiors of panels shall be white, ANSI No. 51.

D. Doors:

1. All control panels shall have a continuous piano hinge door for ease of access. A minimum of 80% of the panel interior shall be exposed by doors.

2. The inside of each door shall be equipped with a print pocket.

3. Two-door enclosures shall have a removable center post.

E. Nameplates:

1. All front-face panel mounted controls shall be equipped with screw mounted laminated plastic nameplates to completely define their use. The use of adhesive to mount front panel nameplates will not be acceptable.

2. All internal components shall be equipped with identification tags

F. Power Supplies.

1. An Uninterruptible Power Supply (UPS) shall be provided as follows:

   a. Size the UPS for all internal equipment plus an additional 20% spare capacity.

b. Provide 30 minute battery back-up capability at full load.

c. Provide Invensys Powerware Ferrups or approved equal.

2. Provide isolated 24 Volt DC power supplies as follows:

a. Redundant supplies with separately fused connections to power the PLC and miscellaneous field instruments as shown in the Contract Drawings.

b. A wetting supply for interposing relay contacts that provide discrete inputs to the PLC, separately fused for each input group. An additional, separately fused connection, from this supply shall also power the discrete output isolation relay coils.

c. A loop power supply for analog inputs, with each analog input separately fused.

G. Electrical:

1. Main circuit breaker and branch circuit breaker for each branch circuit as required to distribute power from the main power feed.

2. All breakers accessible when the panel door is open.

3. No more than 20 devices on any single circuit.

4. No more than 12 amps for any branch circuit.

5. Panel (or site) lighting, receptacles, heaters, controls, telemetry and fans on separate branch circuits.

H. Wiring:

1. Power wiring shall be 300 volt; type THWN stranded copper, No. 14 AWG size, for 120V service.

2. Discrete wiring shall be 300-volt type THWN stranded copper, sized for the current carried, but not smaller than No. 16 AWG.

3. Analog signal wiring shall be 300 volt, stranded copper in twisted shield pairs, no smaller than No. 16 AWG.

4. Panel wiring shall be routed within wire troughs or panduits.

5. Hinge wiring shall be secured at each end with the bend portion protected by a plastic sleeve.

6. Analog or dc wiring shall be separated from any ac power or control wiring by at least six inches.

7. Each wire shall be uniquely identified at all terminations using machine printed plastic sleeves

7. Terminal blocks shall be provided for all field wiring entering the panel. The greater of 4 or 15% spare terminal blocks shall be provided.

8. No more than one wire per field termination point.

I. Construction:

1. Minimum metal thickness: 14-gauge.

2. Stiffeners as required to prevent deflection under instrument loading and permit lifting without racking or distortion.

3. When required, removable lifting rings and fill plugs to replace rings after installation.

4. All components and terminals shall be accessible without removing other components except for covers.

J. The panel shall be a manufactured item, Hoffman Engineering, or equal.

2.07 PANEL DEVICES

A. Selector Switch. Units shall meet the following:

1. Heavy-duty, oil-tight, industrial type selector switches rated for NEMA 4 service.

2. Contacts rated for 120-volt ac service at 10 amperes continuous.

3. Number of positions and contact arrangements as required.

4. Factory-engraved legend plate indicating position definition.

5. Panel mounting accommodating panel thickness between 1/16 to ¼ inch.

6. Black knob type operator.

7. Square D Class 9001, Type K; Cutler Hammer Type CH1025 or equal per Orange County Utilities – Appendix D- List of approved products.

B. Pushbutton. Units shall meet the following:

1. Heavy-duty, oil-tight, industrial type push buttons rated for NEMA 4 service.

2. Contacts rated for 120-volt ac service at 10 amperes continuous.

3. Number of positions and contact arrangements as required.

4. Factory-engraved legend plate indicating function.

5. Panel mounting accommodating panel thickness between 1/16 to ¼ inch.

6. Operator: Red extended head for STOP, green flush head for START, black flush head for other functions.

7. Square D Class 9001, Type K; Allen-Bradley type 800T, or equal.

C. Indicating Light. Units shall meet the following:

1. Heavy-duty, oil-tight, push-to-test industrial high-intensity LED type.

2. Rated for NEMA 4 service.

3. Screwed on flat-faced lenses in colors shown on the drawings.

4. Factory-engraved legend plates.

5. Square D, Allen-Bradley, or approved equal.

D. Control/Interposing Relays: All relays shall meet the following:

1. Compact, general-purpose, plug-in type.

2. Socket mounted.

3. Contacts rated for not less than 10 amperes at 120V.

4. Equipped with neon status lights and test buttons.

5. Permanent, legible identification.

6. Potter & Brumfield series KRPA or approved equal.

E. Time Delay Relay. Time delay relays shall meet the following:

1. Available functions: On delay, Off delay, or one shot.

2. Socket mounted.

3. Knob adjustment.

4. Contacts rated for not less than 10 amperes at 120V.

5. Timing range as appropriate for the application.

6. Magnecraft series W211 or approved equal.

F. Terminal Blocks. Terminal blocks shall meet the following requirements:

1. Screw terminals capable of accepting 10-26 AWG wire.

2. Fused disconnect style.

3. DIN-rail mounting.

4. Connectors shall be either copper or steel. Use of aluminum connectors shall not be permitted without prior approval of the Engineer.

5. Phoenix Contact UT4 HES1 or approved equal.

G. Converter, Current-to-Current, Isolator: Units shall receive a 4 to 20 mA dc input signal and shall produce a repeated, isolated, proportional 4 to 20 MA dc output signal into loads in the range of 0 to 1,200 ohms without load adjustments for a 24V dc supply. Units shall meet the following:

1. Input impedance less than or equal to 50 ohms.

2. Accuracy plus or minus 0.25 percent of span.

3. Multi-turn span and zero adjustment.

4. Operate on an isolated 120 volt, 60 Hz power supply.

5. Moore Industries SCT, AGM Electronics PTA 4000, or equal.

2.08 SPARES AND EXPENDABLES

A. Provide the following spare parts:

1. One spare d.c. power supply of each type provided.

2. One spare analog output card and one analog input card.

3. Five percent (rounded up) spare relays of each type provided.

4. Five percent (rounded up) spare surge suppressors of each type provided

B. Provide the following expendables:

1. Two year supply of corrosion inhibitor capsules

2. Ten percent (rounded up) spare fuses (minimum of 10) of each type and rating supplied.

3. Ten percent (rounded up) spare indicator light bulbs (minimum of 20) of each type and color supplied.

PART 3 - EXECUTION

3.01 GENERAL

A. Prerequisite Activities and Lead Times: Do not start the following key project activities until the listed prerequisite activities have been completed and lead times have been satisfied:

1. Hardware Purchasing, Fabrication, and Assembly: Associated design related submittals completed (no exceptions, or approved as noted).

2. Shipment: Completion and approval of all design related submittals.

3. Startup: Operational Checkout Tests.

4. Factory Test: Contractor shall cover all costs for County attendance at the factory test.

5. OWNER Training: Owner Training Plan completed and O&M manuals delivered.

6. Demonstration Tests: Operational Check-out Tests, Startup, OWNER Training, and Demonstration Test Procedures must be complete. Give 4 weeks' notice prior to the planned test start date.

B. The PCP shall be assembled as far as possible at the SYSTEM SUPPLIER's shop. No work, other than correction of minor defects or minor transit damage, shall be done on the panels at the jobsite.

C. Substantial Completion: Substantial Completion for the project is as defined in the General Conditions. However, the following requirements must be fulfilled before consideration will be given for Substantial Completion of the PCP:

1. All PCP submittals have been completed.

2. The PCP has successfully completed the Demonstration Tests.

3. The required OWNER training has been completed.

4. All spares, expendables, and test equipment have been received by OWNER.

D. Final Acceptance: PCP final acceptance is defined as the date when the ENGINEER issues a written notice of final acceptance. For this Section, the following must have been completed before consideration will be given to the issuance of notice of final acceptance:

1. All punch-list items have been checked off.

2. Revisions to the PCP O&M Manuals have been made (that may have resulted from the Demonstration Tests).

3.02 PRODUCT HANDLING

A. Adequately pack manufactured material to prevent damage during shipping, handling, storage and erection. Pack all material shipped to the project site in a container properly marked for identification. Use blocks and padding to prevent movement.

B. Ship materials that must be handled with the aid of mechanical tools in wood-framed crates.

C. Ship all materials to the project site with at least one layer of plastic wrapping or other approved means to make it weatherproof. Anti-stat protection shall be provided for all sensitive equipment.

D. Inspect the material prior to removing it from the carrier. Do not unwrap equipment until it is ready to be installed. If any damage is observed, immediately notify the carrier so that a claim can be made. If no such notice is given, the material shall be assumed to be in undamaged condition, and any subsequent damage that is discovered shall be repaired and replaced at no additional expense to the OWNER.

E. Store and protect equipment until installation following the storage and handling instructions recommended by the equipment manufacturers. Place special emphasis on proper anti-static protection of sensitive equipment.

F. ESD Protection: Provide for the proper handling, storage, and environmental conditions required for the PCP components deemed static sensitive by the equipment manufacturer. Utilize anti-stat wrist straps and matting during installation of these items to prevent component degradation.

G. Protection During Construction: Throughout this Contract, provide protection for materials and equipment against loss or damage and from the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Provide covers for panels and other elements that may be exposed to dusty construction environments. Specific storage requirements shall be in accordance with the SYSTEM SUPPLIER's recommendations.

H. Corrosion Protection: Protect all consoles, panels, enclosures, and other equipment containing electrical or instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, include capsules in the shipping containers, and equipment as recommended by the capsule manufacturer. During the construction period, periodically replace the capsules in accordance with the capsule manufacturer's recommendations. Replace all capsules just prior to Final Acceptance.

I. The CONTRACTOR shall be responsible for any damage charges resulting from the handling of the materials.

3.03 INSTALLATION

A. Install the PCP in the location indicated on the Drawings and follow manufacturers' installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturers' instruction, and these Contract Documents, follow ENGINEER's decision, at no additional cost. Keep a copy of manufacturers' instructions on the jobsite available for review at all times

B. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance. Coordinate I&C work with the OWNER and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the existing plant during construction.

C. Provide finish on instruments and accessories that protects against corrosion by the elements in the environment in which they are to be installed. Finish both the interior and exterior of enclosures. Provide extra paint of each color used in the material from the manufacturer for touch-up purposes.

D. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. Clean and polish the exterior of all panels and enclosures upon the completion of the demonstration tests.

E. Ground each analog signal shield on one end at the receiver end only. Properly ground all surge and transient protection devices. Coordinate grounding system with Division 16, Electrical.

F. For the purposes of uniformity and conformance to industry standard, provide analog signal transmission modes of electronic 4-20 ma DC. No other signal characteristics are acceptable.

G. Fully isolate outputs for transmitted electronic signals between transmitters and receivers, equipment of different manufacturers and between control panels to conform to ISA Standard S 50. 1.

3.04 TRAINING

A. The cost of training programs to be conducted with OWNER's personnel shall be included in the Contract price.

B. The SYSTEM SUPPLIER shall provide detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

C. The SYSTEM SUPPLIER shall make use of teaching aids, manuals, slide/video presentations, etc. All classroom training shall be video-taped. After the training services, such materials shall be delivered to OWNER.

D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the PCP and associated field instruments.

E. All training schedules shall be coordinated with, and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER's working schedule.

F. Provide a minimum of two days training for up to six of the OWNER’s personnel in the maintenance of the hardware which shall include:

1. Training in standard hardware maintenance for the equipment provided.

2. Specific training for the actual hardware configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up.

3. Test, adjustment, and calibration procedures.

4. Troubleshooting and diagnosis.

5. Component removal and replacement.

6. Periodic maintenance.

3.05 TESTING - GENERAL

A. All elements of the PCP, both hardware and software, shall be tested to demonstrate that the total system satisfies all of the requirements of the Contract Documents

B. As a minimum, the testing shall include shop tests, operational check-out tests, and Demonstration Tests.

C. OWNER reserves the right to witness final testing at the panel shop prior to PCP shipment.

D. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system producing the correct result (effect), the specific test requirements will have been satisfied.

E. All tests shall be conducted in accordance with, and documented on, prior approved procedures, forms, and checklists. Each specific test to be performed shall be described and a space provided after it for signoff by the appropriate party after its satisfactory completion. Copies of these signoff test procedures, forms, and checklists will constitute the required test documentation.

F. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation. Define these simulation techniques in the test procedures.

G. The SYSTEM SUPPLIER shall coordinate all of their testing with the CONTRACTOR, the ENGINEER, all affected suppliers, and the OWNER.

H. The ENGINEER reserves the right to test or retest any and all specified functions whether or not explicitly stated in the approved test procedures. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.

3.06 OPERATIONAL READINESS TEST (ORT)

A. Prior to startup and demonstration testing, certify that the PCP (inspected, tested and documented) is ready for operation. These inspections and tests shall include Loop/Component inspections and tests. The SYSTEM SUPPLIER shall fully debug problems in the system as a whole. Final approval of control software will not be

based on written descriptions of software functions alone, but on actual performance in the field.

B. Check the entire PCP for proper installation, calibration and adjustment on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and the PCP Specifications.

C. The Loop/Component Inspections and Tests shall be implemented using approved forms and checklists. These shall be developed by the SYSTEM SUPPLIER and submitted for approval.

D. Loop Status Report: Each control loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the following information and check-off items with spaces for sign-off by the SYSTEM SUPPLIER:

1. Project Name

2. Control Loop Number or description

3. Tag Number or description for each component of the control loop

4. Check-offs/sign-offs for each component for proper installation, termination, and calibration/adjustment

5. Check-offs/sign-offs for the control loop for proper panel interface terminations, 1/0 interface terminations, I/0 signal operation relative to the computer network, and total loop operation ready

6. Space for comments

E. Component Calibration Sheet: Each field instrument element and each PLC I/0 module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry, and a space for signoff by the SYSTEM SUPPLIER:

1. Project Name

2. Component Identification or I/0 Module Number

3. Manufacturer, Model Number/Serial Number of field element

4. Summary of Functional Requirements (scale, range, computing equation, control action, etc.)

5. Calibrations of span, setpoints, and preset adjustable parameters

6. Space for comments

F. Maintain the Loop Status Reports and Component Calibration Sheets at the jobsite and make them available to the ENGINEER at any time.

G. Witnessing: These inspections and tests do not require witnessing. However, the ENGINEER will review the Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Check-out Tests. Correct any deficiencies found.

3.07 FIELD ACCEPTANCE TEST (FAT)

A. Once the PCP has passed the ORT, the SYSTEM SUPPLIER shall perform a witnessed Field Acceptance Test (FAT) on the complete PCP. OWNER to attend Field Acceptance Test. Expenses to be paid by SYSTEM SUPPLIER. The FAT shall demonstrate that the PCP is operating and in compliance with the Contract requirements. Each specified function shall be demonstrated on a paragraph-by-paragraph, and site-by-site basis.

B. Prior to the FAT, the entire installed PCP shall be certified in writing by the CONTRACTOR that it is ready for operation.

C. The system shall operate for a continuous 100 hours without failure before this test will be considered successful.

D. The FAT shall cover the entire PCP, including control functions, alarms, and status monitoring. Test procedures used for shop tests may be adopted for these tests if modified as required.

3.08 30-DAY SITE ACCEPTANCE TEST (SAT)

A. After completion of the Field Acceptance Test, the entire system shall operate for a period of 30 consecutive days, under conditions of full plant process operation, without a single non-field repairable malfunction.

B. Provide complete O&M Manuals for the PCP at the jobsite at least two weeks prior to the SAT.

C. During this test, plant operating and SYSTEM SUPPLIER personnel shall be present as required. The SYSTEM SUPPLIER is expected to provide personnel for this test who have an intimate knowledge of the hardware and software of the system.

D. While this test is proceeding, the OWNER shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.

E. Any malfunction during the tests shall be analyzed and corrections made by the SYSTEM SUPPLIER. The ENGINEER and/or OWNER will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

F. Any malfunction, during this 30 consecutive day test period, which cannot be corrected within 24 hours of occurrence by the SYSTEM SUPPLIER's personnel, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction.

G. Upon completion of repairs, by the SYSTEM SUPPLIER, the test shall be repeated as specified herein.

H. In the event of rejection of any part or function, the SYSTEM SUPPLIER shall perform repairs or replacement within 90 days.

I. All data base errors must be corrected prior to the start of each test period. The 30-day test will not be considered successful until all databases are correct.

J. The total availability of the system shall be greater than 99.5 percent during this test period.

1. Availability is given by "(Total Time-Down Time) / Total Time".

2. Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided, shall not contribute to the availability test times above.

K. Upon successful completion of the 30-day Site Acceptance Test and subsequent review and approval of complete system final documentation, the system shall be considered substantially complete and the warranty period shall commence.

3.09 CONTROL STRATEGIES

A. General. Provide control strategies that meet the following general conditions:

1. Wherever in the descriptions the control strategy refers to the operator, it is intended to mean via the operator graphic screens to be installed on the OWNER's existing Plant Control System.

2. All control strategies shall run within the PLC. Data manipulation (calculated analog values, elapsed time functions, event determination) shall be performed by the PLC for the associated equipment it is monitoring. Any resulting values from these manipulations shall be reported as individual registers. The intent is to avoid utilizing the HMI software for this purpose.

3. The control functions described herein are not intended to be complete comprehensive programming logic descriptions. They describe only the general intended control operation required. Provide complete program logic to completely fulfill the functional requirements indicated.

4. Provide all programming necessary to support the functional requirements of the operator graphic screens.

5. Provide complete debugging services to address issues identified by the OWNER or ENGINEER during and after startup until final acceptance.

B. Station Operational Parameters. Provide the following operator adjustable parameters associated with overall station pumping operations:

1. PSL-A. Lower operating limit for Discharge Pressure (LP-6251).

2. PS-A. Target operating point for Discharge Pressure.

3. PSH. Upper operating limit for Discharge Pressure (LP-6251). Restrict this setting to a maximum of 3 p.s.i. below the setting of the High Discharge Pressure Switch PSH-6245.

4. PS-B. Resume value for Suction Pressure (LP-6225).

5. PSL-B. Advisory low limit for Suction Pressure (LP-6225).

6. PSL-C. Active low limit for Suction Pressure (LP-6225). Restrict this value to a maximum of PSL-B.

7. PSLL. Shutdown low limit for Suction Pressure (LP-6226). Restrict this value to a maximum of PSL-C and a minimum of 3 p.s.i. above the setting of the Low Suction Pressure Switch.

C. Station Operational Control. Provide the operator with BYPASS/ON-LINE and East-South/South-East software select switches. Provided that all Motor Operated Valves (MOV) are in full auto mode (local and via HMI) control the MOV based on these switches as follows:

1. When Station is in Bypass Mode:

   a) MOV-1 shall be normally Closed
   b) MOV-2 shall be normally Closed
   c) MOV-3 shall be normally Open

2. When the Station is Pumping:

   d) MOV-1 shall be normally Open
   e) MOV-2 shall be normally Open
   f) MOV-3 shall be normally Closed

D. Overall Pumping Control Strategy. Establish an automatic pump schedule assignment for the all six pumps (i.e. including future). Omit from the schedule those pumps not in AUTO (including, of course, those not yet installed). Allow the operator to override this and manually assign the pumps. Issue calls for pumps as follows:

Provide a PID control loop that adjusts pump speed to maintain PS-A.

If, during pumping operations, the station suction pressure drops to PSL-B, issue an advisory alarm to the SCADA system.

If, during pumping operations, the station suction pressure drops to PSL-C, issue a further advisory alarm and automatically reduce the discharge pressure setpoint, PS-A, by a preset amount. If after a preset time the suction pressure remains at PSL-C reduce the discharge pressure setpoint again and continue in this manner until the setpoint falls to a preset minimum.

If, having automatically reduced discharge pressure setpoint as a result of the above condition, suction pressure rises to PS-B, increase the setpoint to its previous value. If after a preset time the suction pressure remains at or above PS-B increase the discharge pressure setpoint again and continue in this manner until the setpoint returns to PS-A.

If, during pumping operations, the suction pressure falls to PSLL, stop all pumping and go to BYPASS mode.

Call for another pump if the speed signal is at 100% and the distribution pressure falls to PSL-A. When starting the pump, ramp down existing pump speed until the new pump's speed matches then resume PID control.

Stop the longest running pump if the speed signal is at an operator adjustable low value and the distribution pressure rises to PSH. Restrict the operator adjustment to between 55% and 95% speed.

When all pumps stop, rotate the pump schedule assignment to equalize run times.

Set a software fail for any pump which fails to run within a preset time of being called to start.

Automatically call for the next pump in sequence if a pump fails to start or fails while running.

E. Individual Valve Control. Provide the operator with an OPEN/CLOSE/AUTO select switch for all three MOV and control them as follows:

1. When the select is placed in OPEN, stop all automatic calls for pumping, then open the valve.

2. When the select is placed in CLOSE, stop all automatic calls for pumping, then close the valve.

3. When the select is placed in AUTO, take open and close commands from the Station Operational Control strategy above.

F. Individual Pump Control. Provide the operator with a software HAND/OFF/AUTO select switch and SPEED potentiometer (restricted to the range 55%-100%) and proceed as follows:

1. While the select switch is in HAND run the pump at the speed set by the software potentiometer.

2. While the select switch is in OFF stop the pump and prevent it from running.

3. While the select switch is in AUTO, control the pump based on the overall pumping strategy above.

G. Station Flow Monitoring. Provide the following functions:

1. Monitor for and record minimum and maximum daily 5-minute average values for flow in each direction. Record the date and time of occurrence for each.

2. Accumulate running daily total flows. At midnight, transfer the totals to yesterday's totals and restart from zero.

H. Station Pressure Monitoring. Monitor for and record minimum and maximum daily value of both pressure signals. Record the date and time of occurrence for each.

I. Access Gate Control. Provide an operator controllable software OPEN pushbutton and control the gate operator accordingly.

3.10 OPERATOR GRAPHICS

A. Provide operator graphic screens on the OIU to allow local monitoring and control of the station.

B. The graphic screens shall support all the operator interface functions associated with the PLC control strategies.

C. Provide a master LOCAL/REMOTE software select switch to allow the operator to assign control to the OIU (LOCAL) or the SCADA system (REMOTE).

D. Provide a station process overview screen that contains the following minimum information:

1. Current control source (i.e. LOCAL or REMOTE)
2. Current station status (i.e. BYPASS, ON-LINE pumping east to south, ON-LINE pumping south to east)
3. East and South distribution pressure.
4. Valve position and status for all MOV
5. Status and speed for all pumps
6. Chlorine Residual
7. Current flow rate
8. Totalized daily flow in each pumping direction.
9. Generator status.

E. Ensure that the color standards used on the screens are consistent with the OWNERs other facilities.

F. Ensure that all command functions require a two-step process.

END OF SECTION

SECTION 13330

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM MODIFICATIONS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work includes all modifications to the County's existing SCADA system necessary to incorporate the Pump Control Panel (PCP), at Orange County, Florida's International Drive Potable Water Booster Pump Station.

B. As the County's existing SCADA service provider the Work defined herein shall be performed by Curry Controls, Lakeland, Florida.

1.02 RELATED WORK

A. Specification Section 13300 defines requirements associated with the PCP, including operator interface functions.

1.03 FINAL DOCUMENTATION

A. Furnish a complete system network diagram of the SCADA system identifying locations, network equipment, and IP addresses of all nodes.

PART 2 – PRODUCTS - THIS PART NOT USED

PART 3 - EXECUTION

3.01 GENERAL

A. The County shall coordinate with the communications provider for provision of a T-1 link between the PCP and the EWRSF SCADA master site.

B. Coordinate closely with the SYSTEM SUPPLIER defined under Specification Section 13300 to ensure PCP compatibility with the SCADA system.

C. Modify all existing reports and databases (e.g. trends, historical, graphics, etc.) to accommodate the new site.

D. Perform all network modifications necessary to add the new site into the system.

3.02 OPERATOR GRAPHICS

A. Provide operator graphic screens on the HMI to allow local monitoring and control of the station.

B. The graphic screens shall support all the operator interface functions associated with the PLC control strategies as defined in Specification Section 13300.

C. Provide graphic screens that replicate those provided with the PCP while taking advantage of the improved graphic capabilities of the SCADA HMI over those of the PCP Operator Interface Unit.

D. Provide on-site time for County review and approval of the new graphics.

3.03 DEMONSTRATION TESTS

A. As part of the final system testing required by Specification Section 13300 paragraph 3.07, demonstrate that the operator interface capabilities from the master SCADA site match those at the pump station.

END OF SECTION

SECTION 13591

NETWORK CABLE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Network Cable section covers the furnishing and installation of cable systems to provide communications for the Network System as indicated on the drawings.

B. Accessories and appurtenances shall be provided as specified herein to provide a complete and properly operating system.

C. Equipment and services provided under this section shall be subject to the requirements specified in the Process Instrumentation and Control System Section and the Ethernet Networks section. Supplementing the Network Cable section, network data, special requirements, and options are indicated on the drawings.

1.02 SUBMITTALS

A. Submittals shall be made as specified in the Process Instrumentation and Control System section.

1. Qualifications: The name, address and telephone number of the proposed Contractor or subcontractor, including specific personnel to perform the work shall be included with the submittals. Provide the experience record of the subcontractor and personnel in performing work similar to that specified. Include the agency, contact person, and telephone number of at least three (3) previous network installation projects completed by the proposed subcontractor. The Engineer shall review and approve the network installation subcontractor and personnel prior to any of the related work being performed. This review will be conducted during the project submittal phase, as described below.
2. Drawings and Data: All material and equipment documentation shall be submitted for review in accordance with the Submittals section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment. Product data shall include the following in the Submittals section:
    a. Cut sheets and catalog literature for proposed fiber optic cable, and fiber optic cable accessories (pigtails, connectors, etc.)
    b. Manufacturer specifications and data that clearly shows that the fiber optic cable meets all requirements as specified herein.
    c. Sample of the proposed cable.
    d. Physical dimension drawings of all fiber optic accessories.
    e. Proposed fiber identification sequence and labeling.
    f. Provide off-line maintenance aids and on-line diagnostics to check the performance of the communication links and interfaces of devices on the data highway.
    g. Provide a Recommended Spare Parts List (RSPL).

h. Provide a list of recommended special tools for fiber installation testing or maintenance.

3. Operations and Maintenance Manuals: Operation and Maintenance Manuals shall have the following items included in addition to those items specified in other sections:
   a. Description of all components.
   b. Methods of connection.
   c. Connection diagram.
   d. OTDR trace plots for all fibers.

1.03 SHIPMENT, PROTECTION, AND STORAGE

A. Equipment provided under this section shall be shipped, protected, and stored in accordance with the requirements of the Process Instrumentation and Control System section.

1.04 QUALIFICATIONS

A. Due to the specialized nature of installing, splicing, terminating, and testing optical fiber cable, the Contractor shall utilize personnel who are experienced in such practices. The installing Contractor or Subcontractor shall have performed similar installation and testing work on at least three projects of similar size and complexity. The personnel assigned to the installation and testing shall also have experience on at least three projects of similar size and complexity.

PART 2 – PRODUCTS

2.01 GENERAL

A. All fiber optic cable, fiber optic hardware and accessories shall be designed, assembled and connected in accordance with the requirements of these specifications and the drawings.

2.02 ETHERNET UNSHIELDED TWISTED PAIR (UTP) CABLE

A. Ethernet cables and connectors shall be provided for a complete and working system, and/or as shown on the drawings. Cable for Ethernet wiring shall be UTP Cat-6 cable. Cable shall be Cat-5e for network speeds up to 100 MHz, and Cat-6 for network speeds greater than 100 MHz. Jacket color coding for cables shall be as follows:

1.	Standard Cat-6.	Yellow
2.	Crossover cables.	Red

B. Cable shall meet the following characteristics:
   1. Category 6 UTP Cable. Cat-6 cable shall meet the following requirements:
      a. 24 AWG
      b. 4 pair solid strand FEP Teflon insulation
      c. 100 Ohm impedance
      d. 1-250 MHz frequency range

e. Min attenuation 19.9 Db
f. 100 Ohm impedance
g. Min NEXT 44.3dB/100MHz
h. Min PS-NEXT 42.3dB/100MHz
i. Min ELFEXT 27.8dB/100MHz
j. Min PS-ELFEXT 24.8dB/100MHz
k. Min return loss 20.1 dB/100 MHz
l. Max delay skew 45 ns
m. Max propagation delay 540 ns

2. Plenum rated cable shall have FEP insulation jacketing and FEP insulation for conductors. Non plenum rated cable shall have PVC insulation jacketing and polyethylene insulation for conductors.
3. Cat-6 cable shall be Belden 1872 or equal.
4. Ethernet Patch Cables. Pre-wired and terminated patch cables with RJ-45 connectors and lever protecting boot shall be furnished for all connections to computers, network equipment, and controller equipment except where physical conditions (i.e. length over 12 ft. or conduit size) require unterminated wire to be installed. Patch cables shall be Cat-6 and shall meet the requirements of Cat-6 cable specified in this section. Straight through cables shall be wired using the T568-B standard for both connectors as shown in section 3.01, A, 1. Crossover cables shall be wired using the T568-A standard for one connector and the T568-B standard for the opposite end.

2.03 FIBER OPTIC CABLE

A. The fiber optic cable must meet all of the requirements of the following paragraphs.
1. The fiber optic cable must meet the requirements of the National Electrical Code (NEC) Section 770.
2. Riser Applications – Applicable Flame Test UL 1666.
3. Finished cables shall conform to the applicable performance requirements of Table 8-6 and 8-7 in the Insulated Cable Engineers Association, Inc. (ICEA) Standard for Fiber Optic Premises Distribution Cable (ICEA S-83-596).
4. Every fiber in the cable must be usable and meet required specifications.
5. All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification.
6. Each optical fiber shall consist of a doped silica core surrounded by a concentric glass cladding. The fiber shall be a matched clad design.
7. All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 100 kpsi.
8. All optical fibers shall be 100 percent attenuation tested. The attenuation shall be measured at 850 nm, and 1300 nm for multimode fibers. The attenuation shall be measured at 1310 nm and 1550 nm for single-mode fibers. The manufacturer shall store these values for a minimum of 5 years. These values shall be available upon request.
9. The storage temperature range for the cable on the original shipping reel shall be –40°C to +70°C. The operating temperature range shall be –40°C to +70°C. Testing shall be in accordance with FOTP-3.
10. The attenuation specification shall be a maximum attenuation for each fiber at 23 + 5°C.

11. The attenuation of the cabled fiber shall be uniformly distributed throughout its length such that there are no discontinuities greater than 0.2 dB at 850 nm/1300 nm (multimode) in any one kilometer length of fiber.
12. Required Fiber Grade: Maximum Fiber Attenuation at 850 nm shall be 3.5dB/km.
13. Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm.
14. The cable shall contain 24 fibers. Each buffer tube shall contain up to 12 fibers.
15. The fibers shall not adhere to the inside of the buffer tube.
16. Each fiber shall be distinguishable from others by means of color coding in accordance with TIA/EIA-598-A, "Optical Fiber Cable Color Coding."
17. The fibers shall be colored with ultraviolet (UV) curable inks.
18. Buffer tubes containing fibers shall also be color coded with distinct and recognizable colors in accordance with TIA/EIA-598-A, "Optical Fiber Cable Color Coding."
19. In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.
20. The buffer tubes shall be resistant to kinking.
21. The cable jacket color shall be black.
22. Fibers may be included in the cable core to lend symmetry to the cable cross-section where needed. Fibers shall be placed so that they do not interrupt the consecutive positions of the buffer tubes. In dual layer cables, any fillers shall be placed in the inner layer. Fillers shall be nominally 3.0 nm in outer diameter.
23. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand the stresses expected in normal installation and service.
24. The outer cable jacket shall be marked with the manufacturer's name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two feet (e.g. "62.5/125 MICRON – TYPE OFNR – (UL) 00001 Feet"). The print color shall be white.
25. The cable shall be all-dielectric.
26. The cable shall be gel-free.
27. The outside diameter of the cable shall not exceed 7 mm.
28. Flammability – All cables shall comply with the requirements of the 1996 NEC Article 770. All cables shall pass UL 1666.
29. Fiber optic cable shall be as manufactured by Corning Cable Systems, Belden, BICCGeneral, AMP or equal.

B. Multimode Fiber. Multimode fiber shall be 62.5/125μm core diameter cable.
1. 62.5 μm core diameter multimode fiber optic cable shall meet the following requirements:
    a. The multimode fiber utilized in the cable specified herein shall meet EIA/TIA-492AAAA-1989, "Detail Specification for 62.5 μm Core

Diameter/125 µm Cladding Diameter Class Ia Multimode, Graded Index Optical Waveguide Fibers."

b. Core diameter: 62.5 ± 3.0 micrometers.
c. Cladding diameter: 125.0 ± 2.0 micrometers.
d. Core-to-Cladding Offset: ≤ 3.0 micrometers.
e. Cladding non-circularity: ≤ 2.0%. Defined as: [1-(min. cladding dia. + max. cladding dia.)] X 100.
f. Core non-circularity: ≤ 6.0%. Defined as: [1-(min. core dia. + max. core dia.)] X 100.
g. Coating Diameter: 245 ± 10 micrometers.
h. Graded index.
i. Numerical Aperture: 0.275 ± 0.015.
j. Attenuation Uniformity: There shall be no point discontinuities greater than 0.2 dB at either 850 nm or 1300 nm.
k. Minimum Bandwidth Requirement shall be 160/500 MHz-km at 850/1300 nm.

C. Singlemode Fiber. Not used.

D. Fiber optic cable connectors. All optical fibers shall be terminated with connectors that are type ST for multimode cable.
1. Epoxy Connectors: Epoxy connectors shall be provided to terminate each fiber in the cable. Connector style, ST shall be coordinated with the patch panels and field devices that will interface directly with the cable. Connectors shall be compatible with the supplied cable. Connector loss shall be no greater than 0.3 dB. Loss measurement shall be performed at the time of splicing and documentation shall be furnished for each termination. Connectors shall be Corning Cable Systems Connectors, or equal.
2. Crimp Style Connectors. Not used.

E. Fiber Optic Jumper Cables: Fiber optic jumper cables shall be furnished and installed for equipment interfacing and between termination cabinets. The jumpers shall meet the following requirements:
1. The jumpers shall be 62.5/ 125 microns, multimode for operation at 1300 nm. They shall be tight-buffered and be protected by Kevlar-type strength material.
2. The jumpers shall be supplied with connectors on each end. Connector type ST shall be matched to the equipment provided. Jumpers shall be sized to provide a single connection between the fiber optic hardware being connected.

2.04 ETHERNET CABLE TEST EQUIPMENT

A. One hand-held network cable tester that is compatible with the provided network cabling shall be provided. The cable tester shall check for open pairs, shorted pairs, crossed pairs, reversed pairs and split pairs for faults up to 100 m. Tester shall be Black Box "Model Localmap 100 TS620A", Fluke MicroScanner2 Pro, or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The System Supplier shall be responsible for the coordination of the installation of all cable furnished hereunder. The System Supplier shall be responsible for the termination of all cable furnished hereunder.

1. Cable Damage: If the cable becomes damaged during installation, the Contractor shall stop work and notify the Engineer immediately. The County and Engineer will decide whether to replace the entire reel of cable or to install a splice at the damaged section. If the County decides to replace the entire reel of cable, the Contractor shall begin the installation at the last designated splice point. The damaged cable between these points shall be removed, coiled, tagged, and given to the County. Installation of new cable to replace damaged cable shall not be a basis of extra payment or contract completion time. In addition to installation of the new cable, the Contractor shall reimburse the County for the entire cost of the replacement reel of cable. This cost will be withheld from the contract price. If the County decides to install a splice at the damaged point, and the cable is damaged a second time, the entire reel of damaged cable (and all subsequent damaged reels) shall be replaced with new reels at the Contractor's expense.

2. Ethernet Cable Installation: Straight through cables shall be wired using the T568-B standard for both connectors as shown in the table below (connector pin numbers are left to right with the clip down). Crossover cables shall be wired using the T568-A standard for one connector and the T568B standard for the opposite end as shown in the table below.

Connector Pin	568A Wiring Conductor	568B Wiring Conductor
1	White/Green	White/Orange
2	Green	Orange
3	White/Orange	White/Green
6	Orange	Green
4	Blue	Blue
5	White/Blue	White/Blue
7	White/Brown	White/Brown
8	Brown	Brown

3. Fiber Optic Cable Installation: Every plant connection between buildings will be fiber connection. The cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification. Fiber optic cable installation shall meet the following requirements:

a. All fiber optic cable shall be installed, terminated, and tested by the System Supplier or his fiber subcontractor as specified above.

b. In pulling the cable, strain-release, or other tension limiting devices shall be used to limit the pull tension to less than 600 lbs.
c. Minimum bend radius restrictions shall be satisfied both during and after cable installation.
d. Horizontal, unsupported cable runs shall be supported at continuous distances of 5 feet or less.
e. All conduit and cabinet entrances shall be sealed with RTV or other reenterable sealant material to prevent ingress of water, dust or other foreign materials.
f. Cable routing within occupied office areas shall conform to Federal, State, and local electrical and fire codes.
g. Any non-terminating (field) splices shall be documented as to the physical location and cable meter mark (prior to stripping). Field splices shall be OTDR-tested and documented prior to final cable acceptance testing.
h. Fiber optic cables shall be installed in accordance with NECA 301-2004, Installing and Testing Fiber Optic Cables.
i. System Supplier must provide Contractor a schedule of completion for the installation of fiber connection between all buildings.

3.02 CABLE TESTING

A. After the network cabling has been installed, each network cable shall be tested.
1. Test Equipment: Unless specified otherwise, all test equipment for the calibration and checking of system components shall be provided by System Supplier for the duration of the testing work and this test equipment will remain the property of System Supplier.
2. Ethernet UTP Cable Testing: The System Supplier shall utilize the previously specified test equipment, and additional tools as needed to validate the Ethernet UTP cable installation. All test equipment shall bear current calibration certification from a certified calibration laboratory, as appropriate. Each cable shall be tested for open pairs, shorted pairs, crossed pairs, reversed pairs and split pairs. A check off sheet shall be utilized, shall be signed by the technician testing the cables, and shall be submitted for approval. Any identified faults shall be corrected at no additional cost.
3. Fiber Optic Cable Testing: Acceptance testing of the data highway (fiber and electronic equipment) shall be conducted as a part of integrated system field testing, as specified elsewhere. Prior to such tests, however, the fiber optic cable shall be tested as specified herein.
a. The System Supplier, or his fiber subcontractor, shall conduct fiber optic cable testing as specified below. All testing following field installation shall be witnessed by the Engineer. A test plan shall be submitted prior to the proposed test dates. The test plan and procedures shall be mutually agreed to prior to conducting the tests.
b. Each optical fiber of each fiber optic cable shall be OTDR (Optical Time Domain Reflectometer) tested on the reel at the factory, on the reel upon arrival at the jobsite, and after installation and termination. For each fiber, an OTDR (Optical Time Domain Reflectometer) trace soft/hardcopy is required to be provided to the County and Engineer. OTDR traces shall be provided for each test (at the factory, on the

reel at the job-site, and after installation). A 100 foot launch cable shall be spliced to each fiber for each fiber OTDR test, to ensure accurate results. This end-to-end trace shall be performed from BOTH ends of the fiber. Also for each fiber, an end-to-end power attenuation (insertion loss) test shall be performed. The attenuation test shall use a stabilized optical source and an optical power meter calibrated to the appropriate operating wavelength (1300 nm).

c. For each installed fiber, the power attenuation shall not exceed the following, tested from connector to connector at the respective patch panels:

$$(0.0035)L + (0.25)N + 3.0 \text{ dB}$$

Where L = the length of the fiber optic cable in meters and N = the number of splices in the fiber.

d. Any fiber optic cables containing one or more fibers not meeting this performance will not be accepted by the County, and shall be repaired or replaced at no additional cost.

e. Each fiber optic jumper cable shall be tested and must exhibit an end-to-end attenuation of less than 2.0 dB at 1300 nm. Any jumper exceeding this level shall be replaced at no additional cost to the County. Any damaged cable still on the reel shall be returned to the manufacturer for replacement at no additional cost to the County.

f. All fiber cable testing shall be documented on pre-approved test forms. Three (3) copies of all documentation (including OTDR traces) shall be submitted to the Engineer upon successful completion of the testing.

END OF SECTION

SECTION 14620
OVERHEAD CONVEYANCE SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the materials, installation, and testing of an overhead conveyance system consisting of a monorail trolley track, motor-driven trolley, electric wire rope hoist, and controls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Miscellaneous Metals: Section 05500.

B. Painting and Coating: Section 09900

C. General Electrical Requirements: Section 16050

D. Electric Motors: Section 16150

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Submit manufacturer's catalog data and dimensioned drawings for trolleys, hoists, rails, and controls.

C. Show areas to be coated and type of coating.

D. Submit electrical drawings showing wiring, disconnect switch, terminals, limit switches, and fuses. Label each terminal showing which control or electric power wire connects to each terminal. Submit motor data showing motor horsepower, enclosure, and NEMA design classification.

E. Submit manufacturer's field assembly and installation instructions.

F. Submit calculations showing that runway and trolley stops resist the forces applied.

G. Submit test report describing procedures and results of both shop and field tests.

1.04 MANUFACTURER'S SERVICES

A. Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded. Contractor shall provide a minimum 7-day notice to County for scheduling the manufacturer’s on-site services:

1. One labor day to check the installation and advise during start-up, testing, and adjustment of each overhead crane system in the project.
2. One labor day to instruct the County's personnel in the operation and maintenance of each overhead crane system in the project.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Underhung trolley and hoist system shall be manufactured by Accolift, Advantage, Elephant, or equal.

2.02 STANDARDS, SPECIFICATIONS, AND CODES

Design and construction of motorized hoists, chain-operated and motor-driven trolley systems shall conform to ANSI HST-4-1999 (reaffirmed 2004), ANSI MH27.1, and ASME B30.11.

2.03 MOTORIZED HOIST

A. Hoists shall be electric, wire-rope type. Hoisting machinery shall consist of a rope drum driven through gear reductions by an electric motor with hoisting rope, sheaves, and hoist brake. Hoist and trolley shall be a standard package of a single trolley/hoist manufacturer. Provide true vertical lift. Design and construct hoists in accordance with ANSI HST-4-1999 (reaffirmed 2004) as appropriate.

B. Provide drums grooved to 50% (minimum) of the rope diameter to protect against rope pileup. Hoisting rope shall be of plow steel or improved plow steel, flexible, designed and manufactured for crane and hoist service, and complying with ANSI HST-4-1999 (reaffirmed 2004).

C. Provide two brakes for hoist, each brake capable of independently holding the hoist's rated load capacity. One brake shall be a fail-safe electric type, connected to the motor shaft or to a shaft in the hoist gear train. The second brake shall be a mechanical load brake mounted in the gearbox and operating in a continuous oil bath. Both brakes shall operate when power to the motor is shut off or there is a power failure. Hoist brakes shall comply with ANSI HST-4-1999 (reaffirmed 2004).

D. Provide upper and lower adjustable geared limit switch.

E. Design load hook so that it opens slowly before hook failure when the hoist is overloaded. Provide hook latch. Provide gauge marks to show if hook has opened up.

F. Provide hoist block with steel-enclosed housing.

G. Provide mechanical or electrical overload protection to prevent lifting of loads exceeding the rated capacity of the crane.

2.04 MOTORIZED TROLLEY

A. Trolley frame shall be welded steel, cast steel, or ductile iron.

B. Design wheel and axle system to prevent a drop of more than 1 inch in case of axle failure.

C. Trolley drive shall consist of a drive shaft driven by an electric motor through a gear reduction unit. The trolley drive shall drive the trolley wheels either directly or through another gear reduction at the wheels.

D. Gears shall be of the helical, spur, worm, or herringbone type, made from rolled or cast steel, with machine-cut teeth having a 20-degree pressure angle. Horsepower ratings shall be in accordance with AGMA standards for the service factor associated with the ANSI HST trolley service classification. Gears shall be AGMA Class II service. Gearing shall be oil splash lubricated.

E. Provide trolley brakes designed in accordance with ANSI HST-4-1999 (reaffirmed 2004).

F. Provide mechanical stops and limit switches at both ends of trolley travel.

G. Wheels shall be drop forged or rolled steel with heat-treated treads and flanges or cast iron with chilled tread. Wheels and wheel bearings shall comply with ANSI HST-4-1999 (reaffirmed 2004).

2.05 ELECTRIC MOTORS

A. Motors shall be NEMA Design D with high starting torque, low starting current, and high slip at full load.

B. Provide separate motors for bridge, hoist, and trolley drives when motorized units are specified. Provide one motor for hoist. Provide one or two motors for trolley.

C. Select ambient temperature in paragraph below to suit project. Coordinate with project electrical engineer.

D. Motors shall be totally enclosed nonventilated (TENV), with Class B or F insulation, 40°C ambient temperature, and with a temperature rise that does not exceed the insulation class at the duty rating listed in the subsection on "Service Conditions." Provide thermal overload protection either of the thermostatic type in the motor starter or of the relay type in the motor windings. Provide integral motor starters for the bridge, hoist, and trolley motors.

E. Motors shall be single or two speed and have voltage and frequency ratings as specified in the subsection on "Service Conditions." Motor speed shall not exceed 1,800 rpm. Determine the required motor horsepower for the trolley and hoist per ANSI MH27.1 and ANSI HST-4-1999 (reaffirmed 2004).

F. Trolley drive shall consist of a drive shaft driven by an electric motor through a gear reduction unit.

G. Provide limit switches at both ends of trolley travel.

2.06 TROLLEY TRACK

Provide a single girder track to carry the trolley. Track shall meet or exceed the requirements of Sections 3 and 4 of ANSI MH27.1. Provide stop plates at the ends of the track.

2.07 ELECTRICAL EQUIPMENT AND CONTROLS

A. Trolley, and hoist controls shall be by a floor-operated push-button pendant station.

B. Push-Button Pendant Station: Provide momentary contact push buttons. Mount controls in a NEMA 4 enclosure. For direct-hung pendants, provide an offset swing arm. Provide cable lengths such that floating pendants hang 36 inches off the floor and direct-hung pendants hang 12 inches off the floor.

2.08 SERVICE CONDITIONS

1. Hoist performance conditions and design data shall be as shown below.

General:	
Equipment Capacity	2 tons
Equipment Location:	
Service	Indoors environmental temperature range of 40 °F to 110 °F
Altitude	107 feet above mean sea level
Relative Humidity	20 % to 100 %
Main Power Supply	480volts, 60 hertz, 3 phase 4 HP
Motorized Trolley:	
Trolley Speed	Single speed: 30 fpm
Motor Duty Rating	30 minutes per ANSI MH27.1
Trolley Limit Switch	1 foot from West end of girder
	5 feet from East end of girder
Motorized Hoist:	
Type	Standard headroom, single speed: 7 fpm
Maximum Distance From Bottom Flange of Track to Centerline of Hook, with Hook in Maximum Raised Position	24 inches
Service Class	Per ANSI HST-4-1999
Motor Duty Rating	30 minutes per ANSI MH27.1
Control	Push-button pendant
Lift	10 feet
Lower Limit Switch Setting	24 inches above floor
Upper Limit Switch Setting	36 inches below bridge

PART 3 - EXECUTION

3.01 LABELING AND MARKING

A. Provide capacity plates on each side of the trolley/hoist and on monorail. Plates shall be legible from the floor.

B. Provide tags on each piece of equipment requiring lubrication. Tag shall state the following information:
   1. Manufacturer's recommended lubricant, by brand name and number or code.
   2. Frequency of lubrication.
   3. Provide removable paper date calendar on which maintenance personnel can fill in dates of lubrication. Enclose calendar in a plastic shield. Attach calendar to equipment by means of a stainless steel or brass chain.

3.02 LUBRICATION

Provide the manufacturer's recommended lubricants for motors, gears, and other equipment.

3.03 INSTALLING SINGLE GIRDER CRANES

A. For electrical cranes, install runway conductors before the runway rails. The alignment of the conductors shall be horizontal and vertical within a tolerance of ±1/4 inch. Install the runway rail adjacent to the conductors next.

B. Bolt the rail sections together. The rail joints shall be tight and provide a smooth running surface.

C. After assuring that rail alignment is correct, securely fasten the rails to their supports.

D. Install trolley end stops before placing on the runway. Faces of the two end stops at each end of the runway shall form a line perpendicular to the runway rails. Install trolley per the manufacturer's instructions.

3.04 PAINTING AND COATING

A. Coat track, trolley, hoist, gear reducer enclosures, and motors per Section 09900, System No. 3. Apply prime coat at factory. Color of finish coat shall be OSHA Safety Yellow.

3.05 TEST LOAD BLOCK

The test loads used in the field testing shall be the property of the County upon successful completion of the field testing. Place the test loads at the location on the site directed by the County. Provide labels on the test loads describing the equipment for which the loads are to be used, tag number, and weight of the loads.

3.06 FIELD PERFORMANCE TESTING

A. Perform a no-load test and a load test in the presence of the County as follows:

1.No-Load Test:

a. Raise empty block to within about 2 feet of its upper position and stop.
b. Raise empty block until the upper limit trips and stops the hoisting motion. Assure that limit switch trips at the specified setting.
c. Adjust upper limit switch if necessary. Repeat Steps a and b.
d. Lower the block to about 2 feet above its lower position and stop.
e. Lower empty block until the lower limit switch trips and stops the lowering motion. Assure that limit switch trips at the specified setting.
f. Adjust lower limit switch if necessary. Repeat Steps d and e.
g. Do not lower the block beyond the point at which two wraps remain at each end of the drum.
h. Move the trolley.

2. Load Test: After the no-load test and trolley test have been completed, test the system with loads in the following manner:
   a. Raise a load equal to 50% of the rated load no higher than required to clear its supports and stop. Adjust brakes if necessary. Raise load about 3 feet above its supports and stop. Lower load about 12 inches and stop. Check drift of load during stopping. If load drifts, brakes are not in proper adjustment and shall be corrected. Repeat this operation until proper adjustment of the brakes is obtained. Lower load carefully back to its supports.
   b. Follow the same procedure as indicated in Step a above except with a 125% test load; then hoist the load high enough to clear all obstructions. Move trolley across the entire span of bridge or length of track. Transport the test load by means of the bridge or monorail for full length of the runway in one direction with the trolley at one extreme end of the crane and in the other direction with the trolley at the extreme opposite end of the crane. Lower load carefully onto its supports.

B. Trolley Test:

1. Move the trolley to within about 2 feet of its farthest left limit switch position and stop.
2. Move the trolley to the left until the limit switch trips and stops the trolley motion. Assure that limit switch trips at the specified setting.
3. Adjust limit switch if necessary. Repeat Steps a and b.

C. Crane system shall run smoothly, with no binding, stopping, or sticking. Adjust and realign equipment and retest if binding, stopping, or sticking occurs. Motors shall not be overloaded.

END OF SECTION

SECTION 15012
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Ductwork and accessories.
   5. Sound control devices.
   6. Vibration control devices.
   7. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process; 2012

1.03 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.

c. Process of performing operational checks of each controlled component.
d. Plan and process for calibrating valve and damper actuators and all sensors.
e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has "passed" and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
   a. Floor.
   b. Room number.
   c. Room name.
   d. Air handler unit ID.
   e. Reference drawing number.
   f. Air terminal unit tag ID.
   g. Heating and/or cooling valve tag ID.
   h. Minimum air flow rate.
   i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:

a. Sequences of operation.
b. Control drawings.
c. Points lists.
d.. Controller and/or module data.
e. Thermostats and timers.
f. Sensors and DP switches.
g. Valves and valve actuators.
h. Dampers and damper actuators.
i. Program setups (software program printouts).

E. Project Record Documents: See Section 01720 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01820, include:
1. Follow the recommendations of ASHRAE Guideline 1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01820 for additional requirements.
1. Provide one copy of the controls training manuals in a separate manual from the O&M manuals.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of the County.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to County; such equipment, tools, and instruments are to become the property of County.

PART 3- EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
   1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with the contract documents.
   1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.02 INSPECTING AND TESTING – GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.

5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Coil Valve Leak Check:
   1. Method 1 - Water Temperature With 2-Way Valve:
      a. Calibrate water temperature sensors on each side of coil to be within 0.2 degree F of each other.
      b. Turn off air handler fans, close outside air dampers. Keep pump running. Make sure appropriate coil dampers are open.
      c. Normally closed valves will close.
      d. Override normally open valves to the closed position.
      e. After 10 minutes observe water delta T across coil. If it is greater than 2 degrees F, leakage is probably occurring.
      f. Reset valve stroke to close tighter.
      g. Repeat test until compliance is achieved.
   2. Method 2 - Air Temperature With 2 or 3-Way Valve: Water leak-by less than 10 percent will likely not be detected with this method.
      a. Calibrate air temperature sensors on each side of coil to be within 0.2 degree F of each other.
      b. Air handler fans should be on.
      c. Change mixed or discharge air setpoint, override values or bleed or squeeze bulb pneumatic controller to cause the valve to close.
      d. After 5 minutes observe air delta T across coil. If it is greater than one degree F, leakage is probably occurring.
      e. Reset valve stroke to close tighter.
      f. Repeat test until compliance is achieved.
   3. Method 3 - Coil Drain Down: Not for 3-way valves.
      a. Put systems in normal mode.
      b. If cooling coil valve, remove all call for cooling; if heating coil valve, put system in full cooling.
      c. Close isolation valve on supply side of coil, open air bleed cap, open drain-down cock and drain water from coil.
      d. If water does not stop draining, there may be a leak through the control valve.
      e. Return all to normal when done.

F. Isolation Valve or System Valve Leak Check: For valves not by coils.
   1. With full pressure in the system, command valve closed.
   2. Use an ultra-sonic flow meter to detect flow or leakage.

G. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to County.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to County.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.

5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to County.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to County.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. "After hours" use tracking and billing.
14. Communications to remote sites.
15. Fire alarm interlocks and response.
16. Fire protection and suppression systems interfaces.
17. Security system interlocks.
18. That points that are monitored only, having no control function, are reporting properly to the control system.
19. All control strategies and sequences not tested during controlled equipment testing.
20. Trend logging and graphing features that are specified.
21. Other integrated tests specified in the contract documents
22. That control system features that are included but not specified to be setup are actually installed.

H. Perform and submit trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the control system:
1. Duty cycling, if specified.
2. Demand limiting, including over-ride of limiting.
3. Sequential staging ON of equipment; optionally demonstrate manually.
4. Optimum start-stop functions.
5. Miscellaneous equipment current or status for duty cycling and demand limiting.
6. Equipment or building kW or current for demand limiting.
7. Equipment optimum start/stop functions.

I. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to County.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Architect to manuals prior to submission to County.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to County.

3.06 DEMONSTRATION AND TRAINING

A. Demonstrate operation and maintenance of HVAC system to County' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

C. Provide classroom and hands-on training of County's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:
   1. HVAC Control System: 1 hours.

D. TAB Review: Instruct County's personnel for minimum 1 hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

END OF SECTION

SECTION 15062
DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install, all ductile iron piping, ductile iron fittings, and appurtenances as shown on the Drawings and as specified herein.

B. General Design: The equipment and materials specified herein are intended to be standard types of ductile iron pipe and cast or ductile iron fittings for use in transporting wastewater, potable water, and reclaimed water

1.02 QUALITY ASSURANCE

A. Qualifications: All of the ductile iron pipe and ductile or cast iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Standards:
   1. ANSI A 21.50/AWWA C150
   2. ANSI A-21.51/AWWA C151
   3. ANSI A-21.41/AWWA C104

C. Factory Tests: The manufacturer shall perform the factory tests described in ANSI A-21.51/AWWA C151.

D. Quality Control
   1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards. All pipe on this Project shall be supplied by a single manufacturer unless otherwise accepted in writing by the County.
   2. In addition to the manufacturer's quality control procedures, the County may select an independent testing laboratory to inspect the material at the foundry for compliance with these specifications. The cost of foundry inspection requested by the County will be paid for by the County.

1.03 SUBMITTALS

A. Materials and Shop Drawings
   1. Submit Shop Drawings and piping layouts, including areas within and under buildings and structures. Shop Drawings shall include dimensioning, methods and locations of supports and all other pertinent technical specifications. Show locations of all field cuts. Shop Drawings shall be prepared by the pipe manufacturer. Shop Drawings for piping within and under buildings and structures shall be submitted within 30-days of Execution of Contract.

B. Operating Instructions: Submit Operation and Maintenance Manuals in accordance with Section 01001 "General Work Requirements."

C. Manufacturer's Certification
   1. Submit manufacturer's sworn certification of factory tests and test results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the County, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. Stored pipe shall be covered for protection against contamination and UV light. Joint gaskets shall be stored in clean, dark and dry location until immediately before use.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe and fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of the County or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the County, is damaged beyond repair by the Contractor shall be removed from the site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe
   1. Standards: ANSI A-21.50, AWWA C150 and ANSI A-21.51, AWWA C151
   2. Thickness/Pressure Class:

a. Below ground piping: Class 350 (4-inch to12-inch), Class 250 (16-inch to 24-inch) and Class 200 (30-inch to 64-inch) unless otherwise noted or specified.
b. Above ground piping: Flanged, Class 350 (minimum) unless otherwise noted or specified.

3. Joints
   a. Push-on or Mechanical Joints (below ground piping)
      (1) Standards: ANSI A21.11, AWWA C111
      (2) Class: 350-psi working pressure rating
      (3) Gaskets
         (a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type.
         (b) Wastewater Service: Neoprene rubber ring type.
   b. Flanged (above ground or inside below ground vaults)
      (1) Standards: ANSI A21.15, ANSI B16.1
      (2) Class: 125-pound factory applied screwed long hub flanges, plain faced without projection.
      (3) Gaskets
         (a) Spans less than 10-feet: full-face 1/8-inch thick neoprene rubber
         (b) Spans greater than 10-feet: Toruseal gaskets as manufactured by American Cast Iron Pipe or acceptable equal.
   c. Restrained Joints
      (1) Manufacturers: Lok-Ring system (all sizes) or locking type gasket systems (for 16-inch diameter and smaller) as manufactured by American Ductile Iron Pipe; MEGALUG System as manufactured by EBBA Iron; or acceptable equal.
      (2) Class: 250-psi minimum design pressure rating.
      (3) Standard mechanical joint retainer glands shall not be acceptable.
   d. Joint Accessories
      (1) Mechanical joint bolts, washers and nuts: Ductile iron or Corten steel.
      (2) Flanged joint bolts, washers and nuts: 316 stainless steel with bolts and nuts conforming to ASTM A193 Grade B8M.
   e. Pipe Length (below ground installation): 20-feet maximum nominal length.

4. Pipe Identification
   a. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe which is not clearly marked is subject to rejection. The Contractor shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.

B. Fittings

1. Ductile iron fittings 4-inch through 24-inch shall be pressure rated at 350-psi minimum, except flanged joint type fittings which shall be rated at 250-psi minimum. All 30-inch and larger fittings shall be pressure rated to 250-psi minimum. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline. All fittings shall be designed to be capable to withstand, without bursting, hydrostatic tests of three times the rated water working pressure. All fittings shall have a date code cast (not printed or labeled) with identification of date, factory, and the factory unit from which it was cast and machined. Fittings shall have the pressure rating, nominal diameter of

openings, manufacturer's name, and the country where cast and number of degrees or fraction of the circle distinctly cast on them. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them.

2. Joints shall be as described for ductile iron pipe for above ground/exposed and buried service.
3. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.

2.02 COATINGS, LININGS AND IDENTIFICATION MARKINGS

A. Exterior Coatings
   1. Below ground/buried or in a casing pipe:
      a. Type: Asphaltic coating, 1.0-mil DFT in accordance with ANSI/AWWA A21.51/C151.
      b. Markings: (continuous 3-inch wide strip within top 90 degrees of pipe - min. drying time 30-minutes before backfill).
      c. Color:
         (1) Raw Wastewater: Safety Green
         (2) Reclaimed Water: Purple (Pantone 522C)
         (3) Potable Water: Safety Blue
   2. Above ground/Exposed/In vaults
      a. Coatings and coating testing for ductile iron pipe and fittings for above ground/exposed applications shall be accordance with Division 9. Primer, intermediate and final coats whether shop or field applied shall be compatible and applied in ac accordance with the coating system manufacturer's recommendations. Refer to Appendix D "List of Approved Products" for approved coating system suppliers. Asphaltic seal coat applied to the exterior of above ground piping and fittings shall be blasted and completely removed prior to coating per NACE-3/SSPC-SP6 commercial blast cleaning minimum angular anchor profile of 1.5-mils.
      b. Color
         (1) Raw Wastewater: Safety Green
         (2) Reclaimed Water: Purple (Pantone 522C)
         (3) Potable Water: Safety Blue
   3. Inside Wetwell
      a. All piping inside of wastewater wetwell shall be 316 stainless steel.

B. Interior Lining (Applied by pipe manufacturer)
   1. Wastewater: Interior coating shall be Protecto 401 (amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment) for all pipe and fittings. All ductile iron pipe and fittings shall be delivered to the manufacturer certified applicator without asphalt, cement lining, or any other lining on the interior surface and no coating shall have been applied to the first 6-inches of the exterior of the DIP spigot ends. Minimum surface preparation shall be SSPC-SP 1 Solvent Cleaning method to remove oil and grease followed by NACE-4 / SSPC-SP7 Brush-Off Blast Cleaning. Protecto 401 shall be applied within 12-hours of surface preparation to the interior of the pipe and fittings so as to obtain a continuous and relatively uniform and smooth integral lining with a total minimum dry film thickness of 40-mils for the complete system. No lining shall take place when the

substrate or ambient temperature is below 40°F. The lining shall not be used on the face of the flange of fittings or flanged pipe. The system shall be holiday free and holiday testing (minimum 2000 volts) shall be conducted and pinholes shall be repaired prior to shipping.

2. Potable Water and Reclaimed Water: Interior coating shall be fusion-bonded epoxy (FBE) or Cement Mortar lined with asphaltic seal coat.
   a. FBE for Fittings: Fittings shall be supplied with a FBE coating, both inside and outside for total protection including flanged and buried fittings. The exterior of flanged fittings for above ground assemblies shall adhere to final exterior coating requirements per 3119 2.04 A. The FBE coating system shall meet or exceed ANSI/AWWA C-550 and C116/A21.116 requirements and shall have NSF 61 certification. FBE coating thickness shall be 6 to 8-mils dry film thickness, shall be applied for secure adhesion, shall have a smooth surface and shall be holiday free.
   b. Cement mortar lining with a seal coat of asphaltic material shall be in accordance with ANSI/AWWA A21.4/C104.

C. Polyethylene Encasement is required when pipe is within 10-feet of a gas main or as indicated on the Drawings:
   1. Standard: ANSI A 21.5/AWWA C105, 8-mil minimum thickness.

2.03 LOCATION MARKERS AND LOCATION WIRE

A. Electronic Markers and Locator System (for reclaimed water and wastewater ONLY)
   1. Markers: Markers shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility (service) being installed. Markers shall be color coded in accordance with American Public Works Association's "Utility Locating and Coordinating Council Standards." Colors shall be: Wastewater and Reclaimed Water - #1404 Green. Markers shall be full range. Markers shall be installed directly above the centerline of the respective pipeline at intervals not to exceed 100-feet, at each fitting (tees, wyes, crosses, reducers, plugs, caps and bends) or change in horizontal direction and at each valve along the pipeline. Markers shall be hand backfilled to 1-foot above the pad and have a finished depth of burial of not less than 2-feet or more than 6-feet. No separate payment shall be made for furnishing and installing the respective frequency and color-coded electronic pad type marker.
   2. Locator System: Marker locator set shall be the Scotch Mark EM II Electronic Marker Locator Path Tracing Receiver, or acceptable equal. The Contractor shall furnish 1-locator set for each type of service piping installed on the project (i.e.: reclaimed water, wastewater) to the County. Each unit shall incorporate the following features and accessories:
      a. Unit(s) shall be tuned to the proper frequency for each type (service) of piping.
      b. Field strength meter that provides visual indication of the return signal.
      c. Function switch for selection of operation mode.
      d. Sensitivity control to adjust the receiver gain.
      e. Audio speaker for signal response.
      f. Battery access panel containing condensed operating instructions.
      g. Auxiliary headset and heads set jack.
      h. Permanently attached shoulder straps.
      i. Rugged shockproof and weatherproof storage/carrying case.
   3. Manufacturer: System shall be Scotch Mark Locator System, or acceptable equal.

B. Location Detection Wire
   1. Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).
   2. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 12-inches above top of box (stored inside the 2-inch brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of 2 (two) 10-gauge wires shall be pulled along with the pipe.
   3. Continuity: Continuity of wire to be tested using Metrotech 810/9860 or acceptable equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ductile iron pipes shall be installed in accordance with AWWA C600 and AWWA Manual M-42. When a restraining type gasket is used, the bell shall be painted red.

B. Underground Ductile Iron Pipe and Fittings.
   1. Bedding firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.
   2. Placement
      a. Alignment: In accordance with lines and grades shown on the Drawings. Deflection of joints shall not exceed 75% of the values recommended by the pipe manufacturer.
      b. The Contractor shall provide line and grade stakes at a 100-foot maximum spacing and at all line and/or grade change locations. The Contractor shall provide temporary benchmarks at a maximum of 1,000-foot intervals. The minimum pipe cover shall be 30-inches below the finished grade surface or 30-inches below the elevation of the edge of pavement of the road surface whichever is greater.
      c. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked greater than 1-inch shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
      d. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.
      e. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe-laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
      f. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the

pipe shall be closed by a watertight plug or by other means approved by the County to ensure absolute cleanliness inside the pipe. The pipe shall be installed with the color stripe and pipe text on the top of pipe.

3. Cutting: When required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of the pipe to be used with a push-on bell shall be beveled. Bare metal exposed at ends of the pipe shall be field coated in accordance with pipe manufacturer's recommendations. Cut pipe for wastewater service shall have exposed bare metal ends repaired with Protecto 401 using the coating system manufacturer's field repair kit.
4. Joints
   a. Joint Placement
      (1) Push on joints: Pipe shall be laid with the bell facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
      (2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

C. Thrust Restraint
   1. General: Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
   2. Length of Restrained Joints: In accordance with the lengths listed in the table as shown on the Drawings.

D. Installation of Pipes on Curves
   1. Maximum deflections at pipe joints, fittings and laying radius for the various pipe lengths shall not exceed 75% (percent) of the pipe manufacturer's recommendation.

3.02 CLEANING AND FIELD TESTING

A. General: At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in other related sections of these specifications.

END OF SECTION

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SECTION 15064

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all polyvinyl chloride (PVC) piping, fittings and appurtenances as shown on the Drawings and specified herein.

B. General Design: The equipment and materials specified herein are intended to be standard types of PVC pipe and ductile iron fittings for use in transporting wastewater, reclaimed water, and water.

1.02 QUALITY ASSURANCE

A. Qualifications: All of the PVC pipe and ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Standards:
   1. AWWA C900/C905
   1. ASTM D1784 / D1785 / D2241 / D2466 / D2564 / D2729 / D2774 / D3034 / D3139 / D3212
   2. NSF 14
   3. UNI-B-1 through 5

C. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900/C905.

D. Quality Control:
   1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.
   2. In addition to the manufacturer's quality control procedures, the County may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The County will pay for the cost of facility inspection requested by the County.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Materials and Shop Drawings

C. Manufacturer's Certification
   1. Submit sworn certification of factory tests and their results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of County or it shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner to prevent distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the County, is damaged beyond repair by the Contractor shall be removed from the site.

C. The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the County, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe
   1. Standards: AWWA C900/C905 and ASTM D1784/D3034/F679 (Gravity Sewer)
   2. Compounds: Class 12454-A or Class 12454-B
   3. PVC Gravity Pipe and Fittings: PVC gravity pipe (6-inch to 15-inch), shall conform to ASTM D3034, maximum SDR 35. PVC gravity pipe (18-inch to 36-inch), shall conform to ASTM F679 and uniform minimum "pipe stiffness" at 5% (percent) deflection shall be 46-psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI Bell Plastic Pipe Association standard is UNI B.
   4. PVC Pressure Pipe and Fittings: All PVC pipe of nominal diameter 4 to 12-inches shall be manufactured in accordance with AWWA Standard C900 and greater than

12-inches shall be manufactured in accordance with AWWA Standard C905. The PVC pipe shall have a minimum working pressure rating of 100-psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.

5. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)
   a. Raw Wastewater:
      (1) Pressure Systems: DR 18
      (2) Gravity Systems: DR 35 (ASTM D3034) or PS 46 (ASTM F679)
   b. Treated Wastewater: DR 18
   c. Reclaimed Water: DR 18
   d. Raw Water: DR 18
   e. Potable Water: DR 18
   f. Irrigation Piping: Schedule 40 or SDR 21
6. Joints:
   a. Push-on integral bell elastomeric gasket joints:
      (1) Standards: ASTM D3212/D3139/F477 and UNI-B-1
      (2) Gaskets:
         (a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) rieber type.
         (b) Wastewater Service: Styrene Butadiene Rubber (SBR) rieber type for C900 / C905 pipe. Styrene Butadiene Rubber (SBR) ring type for gravity systems.
      (3) Pipe Markings: Pipes shall have a manufacturer's home-mark on the spigot. On field cut pipe, the Contractor shall provide home-mark on the spigot in accordance with manufacturer's recommendations.
   b. Solvent weld (nominal diameter less than 4-inches):
      (1) Standards: ASTM D2466/D2564
      (2) Type: Slip Fitting Socket (tapered)
      (3) Exclusions: Plastic saddle and flange joints will not be used.
   c. Restrained Joints:
      (1) Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.
      (2) Manufacturers: Uni-flange mechanical joint restraints and bell restraints (for all sizes); Meg-a-lug system as manufactured by EBBA Iron (sizes 12-inches or less), or acceptable equal.
      (3) Design pressure rating equal to or above test pressure as specified herein.
   d. Pipe Length:
      (1) Pressure systems: 20-feet maximum nominal length
      (2) Gravity systems: 13-feet minimum nominal length

B. Fittings - Pressure Systems (nominal diameter 4-inches and greater):
   1. Materials: Ductile iron
   2. Joints: Mechanical Joint, Minimum 350-psi pressure rating
   3. Gaskets:
      a. Water and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type
      b. Wastewater Service: Neoprene rubber ring type
   4. Exclusions: Standard double bell couplings will not be acceptable where the pipe will slip completely through the coupling.
   5. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron.

6. All fittings shall have a date code cast (not printed or labeled), with identification of the date, factory and unit at which it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and deflection angle. Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them.
7. All potable water main fittings shall have NSF certification and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.
8. All ductile iron fittings shall have exterior coatings, including markings and colors, and interior linings in conformance with Section 15062 "Ductile Iron Pipe and Fittings."

C. Fittings - Pressure Systems (nominal diameter less than 4-inches)
1. Material: Polyvinyl Chloride (PVC)
2. Joints: Slip fitting tapered socket with solvent weld
3. Solvent: Sure Guard 12 or acceptable equal
4. Exclusions: Plastic saddle and flange joint fittings shall not be used

2.03 LOCATION MARKERS, LOCATION WIRE AND IDENTIFICATION MARKINGS

A. Location Detection Wire
1. Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).
2. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 18-inches above top of box (stored inside the 2-inch brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of 2 (two) 10-gauge wires shall be pulled along with the pipe.

B. Identification Markings:
1. Pipe furnished in solid color or white with color lettering as indicated below.
a. Lettering along top 90° (degrees) of pipe, minimum 3/4-inch in height with appropriate wording appearing 1 or more times every 21-inches along the entire length of the pipeline.
(1) Raw Wastewater: Safety Green
(2) Reclaimed Water: Purple (Pantone 522C)
(3) Potable Water: Safety Blue

PART 3 - EXECUTION

3.01 INSTALLATION

A. Standards: AWWA C900/C905/UNI-B 3 and 4

B. Underground Polyvinyl Chloride (PVC) Pipe and Fittings
1. Bedding: Firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted

2. Placement/Alignment:
    a. Installation shall be in accordance with lines and grades shown on the Drawings. For pressure systems, deflection of joints shall not exceed 75% of that recommended by the manufacturer.
    b. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
    c. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.
    d. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
    e. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the County to ensure absolute cleanliness inside the pipe. The color stripe and pipe text shall be viewed from the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.
    f. Locating Wire: Locating wire, for electronically locating pipe after it is buried, or installed by trenchless technology shall be attached along the length of and installed with the pipe. This is applicable to all sizes and types of pressure mains. At a minimum, the tracing wire is to be attached to the pipe with nylon wire ties. The wire itself shall be 10-gauge single strand solid core copper wire with non-metallic insulation. The insulation shall be color coded for the type of pipe being installed. Continuous continuity must be maintained in the wire along the entire length of the pipe run. Permanent splices must be made in the length of the wire using wire connectors approved for underground applications as listed in the uniform electric code handbook. The coiled wire shall extend to a minimum of 12-inches above the surface and be connected to a test station box at valve locations.
    g. PVC Pressure Pipe Installation and Training: PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe", AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the bell spigot end be allowed to go past the "insertion line" or "homing mark" for pressure pipe applications and homing mark shall be visible.

h. Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be remarked to the same dimensions as the factory-marked spigot.

i. All Contractor pipe crews utilizing PVC pressure pipe shall be trained on an annual basis by Uni-Bell in coordination with the County and attended by the manufacturer's representative of the respective approved Manufacturers in Appendix D "List of Approved Products." The Uni-Bell PVC training session will consist of proper handling, storage, installation, and compaction as well as County requirements regarding PVC pipe and deflection. Every person handling, installing or backfilling PVC pipe shall not be permitted to install County owned and / or maintained pipe without training.

j. Approved manufacturers' representatives (Appendix D "List of Approved Products"), not present at the hosted Uni-Bell training session or individuals of pipe crews not in attendance shall be trained on every project site. On-site project training shall be for each manufacturer of pipe utilized on-site, per crew and per project. Specifically each crewmember shall be trained on every project by every pipe manufactures representative regardless of previous on-site training. Every person handling, installing or backfilling PVC pipe shall not be permitted to install County owned and / or maintained pipe without training.

k. PVC Gravity Pipe Installation: Gravity sewer pipe shall be installed to the homing mark, no tolerance. Any noticeable separation shall be removed and reinstalled. The homing mark may be disregarded to meet the maximum of 1-inch separation between bell and spigot requirement. Joints:

l. Joint Placement:

(1) Push on joints: Pipe shall be laid with the bell ends facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.

(2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

C. Thrust Restraint

1. Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.

2. Length of restrained joints shall be in accordance with the lengths listed in the table as shown on the Drawings.

D. Installation of Pipes on Curves:

1. No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable tolerance in the joint due to variances in installation is 0.75° (degrees) (3-inches per joint per 20-foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

3.02 CLEANING AND FIELD TESTING

A. At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

END OF SECTION

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SECTION 15082
PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 SUBMITTALS

A. See Section 01300 - Submittals.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.04 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

PART 2 - PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc; www.aeroflexusa.com.
   2. Armacell LLC; www.armacell.us.
   3. K-Flex USA LLC; www.kflexusa.com.
   4. Approved Equal.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F (-40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07840.

I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

J. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Cold Water: Insulation Thickness 3/4"
   2. Plumbing Vents Within 10 Feet (3 Meters) of the Exterior: Insulation Thickness 3/4"

END OF SECTION

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SECTION 15083
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.04 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

PART 2 - PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Approved Equal.

B. Insulation: ASTM C547; rigid molded, noncombustible.
   1. 'K' ('Ksi') value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum service temperature: 850 degrees F (454 degrees C).
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Insulation: ASTM C547; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' ('Ksi') value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum service temperature: 650 degrees F (343 degrees C).
   3. Maximum moisture absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

E. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

F. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

G. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

H. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
   2. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
   3. Weave: 5x5.

I. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

J. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Outdoor Breather Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

L. Insulating Cement:
   1. ASTM C449/C449M.

2.03 CELLULAR GLASS

A. Insulation: ASTM C552, Type 1.
   1. Apparent Thermal Conductivity; 'K' ('Ksi') value: Grade 6, 0.33 at 100 degrees F (0.047 at 38 degrees C).
   2. Service Temperature: Up to 800 degrees F (427 degrees C).
   3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/Pa s m).
   4. Water Absorption: 0.5 percent by volume, maximum.

2.04 EXPANDED POLYSTYRENE

A. Insulation: ASTM C578; rigid closed cell.
   1. 'K' ('Ksi') value: 0.23 at 75 degrees F (0.033 at 24 degrees C).
   2. Maximum service temperature: 165 degrees F (74 degrees C).
   3. Maximum water vapor permeance: 5.0 perms (287 ng/Pa s sq m)

2.05 EXPANDED PERLITE

A. Insulation: ASTM C610, molded.
   1. Maximum service temperature: 1200 degrees F (649 degrees C).
   2. Maximum water vapor transmission: 0.1 perm.

2.06 HYDROUS CALCIUM SILICATE

A. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.

1. 'K' ('Ksi') value: ASTM C177 and C518; 0.40 at 300 degrees F (0.057 at 149 degrees C), when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum service temperature: 1200 degrees F (649 degrees C).
3. Density: 15 lb/cu ft (240 kg/cu m).

B. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12-inch (300 mm) centers.

C. Insulating Cement:
1. ASTM C449/C449M.

2.07 POLYISOCYANURATE CELLULAR PLASTIC

A. Insulation Material: ASTM C591, rigid molded modified polyisocyanurate cellular plastic.
1. Dimension: Comply with requirements of ASTM C585.
2. 'K' ('Ksi') value: 0.18 at 75 degrees F (0.026 at 24 degrees C), when tested in accordance with ASTM C518.
3. Minimum Service Temperature: -70 degrees F (-51 degrees C).
4. Maximum Service Temperature: 300 degrees F (150 degrees C).
5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D2842..
6. Moisture Vapor Transmission: 4.0 perm in (5.8 ng/(Pa s m)).
7. Connection: Waterproof vapor barrier adhesive.

2.08 POLYETHYLENE

A. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
1. 'K' ('Ksi') value: ASTM C177; 0.25 at 75 degrees F (0.036 at 24 degrees C).
2. Maximum Service Temperature: 300 degrees F (150 degrees C).
3. Density: 2 lb/cu ft (32 kg/cu m).
4. Maximum Moisture Absorption: 1.0 percent by volume.
5. Moisture Vapor Permeability: 0.05 perm inch (0.073 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
6. Connection: Contact adhesive.

2.09 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Aeroflex USA, Inc: www.aeroflexusa.com.
2. Armacell LLC: www.armacell.us.
3. K-Flex USA LLC: www.kflexusa.com.
4. Approved Equal.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: -40 degrees F (-40 degrees C).
2. Maximum Service Temperature: 220 degrees F (104 degrees C).
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.10 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (-18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil (0.25 mm).
      e. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic:
      a. Compatible with insulation.

B. ABS Plastic:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: -40 degrees F (-40 degrees C).
      b. Maximum Service Temperature of 180 degrees F (82 degrees C).
      c. Moisture Vapor Permeability: 0.012 perm inch (0.018 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
      d. Thickness: 30 mil (0.76 mm).
      e. Connections: Brush on welding adhesive.

C. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   1. Lagging Adhesive:
      a. Compatible with insulation.

D. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.
   6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

E. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
   1. Thickness: 0.010 inch (0.25 mm).
   2. Finish: Smooth.
   3. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07840.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

K. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

A. Cooling Systems:
   1. Cold Condensate Drains:
   2. Condensate Drains from Cooling Coils:
   3. Refrigerant Suction
   4. Refrigerant Hot Gas

END OF SECTION

SECTION 15086
DUCT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.04 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

PART 2 – PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.
5. Approved Equal.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' ('Ksi') value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:

F. Tie Wire: Annealed steel, 16 gage (1.5 mm).

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Approved Equal.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. 'K' ('Ksi') value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum service temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Sorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   1. Lagging Adhesive:
      a. Compatible with insulation.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square (2.45 kg/sq m).

C. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.
   6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

2.05 DUCT LINER

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Approved Equal.

B. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket; impregnated surface and edges coated with poly vinyl acetate polymer.
   1. Fungi Resistance: ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F (0.045 at 24 degrees C).
   3. Service Temperature: Up to 250 degrees F (121 degrees C).
   4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm (25.4 m/s), minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch (13 mm) Thickness: 0.30.
      b. 1 inch (25 mm) Thickness: 0.45.
      c. 1-1/2 inches (40 mm) Thickness: 0.60.
      d. 2 inch (50 mm) Thickness: 0.70.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

G. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 100 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Combustion Air Duct:
   1. Flexible Glass Fiber Duct Insulation: 1 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1 inches thick.
   3. Flexible Glass Fiber Duct Liner Insulation: 1 inches thick.
   4. Rigid Glass Fiber Duct Liner Insulation: 1 inches thick.

B. Evaporative Condenser Intake and Exhaust:

C. Exhaust Ducts Within 10 ft (3 m) of Exterior Openings:

D. Exhaust Ducts Exposed to Outdoor Air:

E. Outside Air Intake Ducts:

F. Plenums:

G. Plenums (Cooling System):

H. Ventilation Equipment Casings:

I. Supply Ducts:

J. Supply Ducts From Fans to Vertical Ducts in Shafts (Cooling System):

K. Supply Ducts in Vertical Shafts (Cooling Systems):

L. Supply ducts After Terminal Boxes:

M. Return and Relief Ducts in Mechanical Rooms:

N. Ducts Exposed to Outdoors

END OF SECTION

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SECTION 15100
ANCILLARY EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide all valves and appurtenances, ready for operation, as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. All valves, appurtenances, and ancillary equipment shall be products of well-established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 “Submittals.”

PART 2 - PRODUCTS

2.01 GENERAL

A. All valves, appurtenances, and ancillary equipment shall be of the sizes shown on the Drawings and specified herein.

B. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

C. All valves, appurtenances, and ancillary equipment shall be as specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 AIR RELEASE VALVES

A. For Water Service
   1. General: Water mains shall be equipped with combination air release valves located as shown on the Drawings. Valves shall be made to remove air at high points where elevation changes exceed 5-feet. Automatic air release valves shall be located at high points for pipe systems greater than 12-inches in diameter.

2. Water Combination Air Release Valves: The valve body shall be 316 stainless steel, 316 stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim.
3. Fittings from the main to the air release valve shall be threaded and made of brass.

B. Air release valves shall be installed above grade or in an enclosure.

2.03 TAPPING SLEEVES AND VALVES

A. General: Tapping sleeves shall be mechanical joint sleeves.

B. Mechanical Joint Sleeves: Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 and properly recessed for tapping valve. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI/AWWA C111/ANSI A21.11. Sleeves shall be capable of withstanding a 200-psi working pressure.

C. Fabricated Mechanical Joint Tapping Sleeves: Sleeves shall be of split mechanical joint design with separate end and side gaskets. Sleeves shall be fabricated of high strength steel, meeting ASTM A283 Grade C or ASTM A-36. Outlet flange shall meet AWWA C-207, Class "D" ANSI l50-pound drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeve shall have manufacturer applied fusion-bonded epoxy coating, minimum l2-mil thickness.

D. Tapping Valves: Tapping valves shall be resilient seated gate valves flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above and specifically designed for pressure connection operations.
1. Tapping valves with alignment lip shall be placed vertical where possible for Water and Reclaimed Water.
2. Tapping Valves 16-inch and larger shall be AWWA C515 resilient seated only (16-inch and 24-inch no gearing required) above 24-inch shall be installed vertically with a spur gear actuator. When tapping existing mains, valves 24-inch and above shall be furnished with NPT pipe plugs for flushing the tracks.

2.04 VALVE BOXES FOR BURIED VALVES

A. Standard 2-piece Cast Iron Valve Box: Required for mains less than 6-feet below finished grade and less than or equal to 12-inches in diameter.
1. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the County's Representative.
2. The barrel shall be 2-piece, screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with locking cast iron covers. Coat buried cast iron pieces with coal tar epoxy.

B. Valve Box Assembly: Valve box assemblies with operating nut extension is required for any size main that is 6-feet or greater below finished grade or if mains are greater than 12-inches in diameter.
   1. Valve boxes shall be 1 complete assembled unit composed of the valve box and extension stem that attaches and locks to the 2-inch wrench nut. The extension shall be high strength, corrosion resistant steel construction, and permanently attached to the operating nut.
   2. The operating nut extension insert shall be 1 complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths 6-feet and greater as shown in the Drawings. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil.
   3. A valve box-centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable trench depths 6-foot and greater as shown in the Drawings.

C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be at minimum galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1,000-foot-pounds without failure.

D. Valve boxes shall have locking cast iron covers utilizing a 5-sided nut with a special wrench needed to open. Covers shall have "WATER", "SEWER", or "RECLAIMED WATER" cast into the top, as applicable

E. Concrete Collar: Each valve installed in an unimproved area (outside of pavement, driveways or sidewalks) shall require a 24-inch by 24-inch by 6-inch concrete pad or collar as shown in the Drawings.

F. Identification Disc: Each 16-inch or larger valve (unless otherwise shown on the Drawings) installed shall be identified by a 3-inch diameter bronze disc anchored in the concrete pad or collar in unimproved areas and/or anchored on a 4-inch by 4-inch by 18-inch long concrete post set flush with the pavement surface in improved areas. The disc shall be stamped with the following information as shown on the Drawings:
   1. Size of the valve
   2. Type of valve
   3. Service
   4. Direction and number of turns to open

G. Valve markers are to be made of schedule 80 PVC and have decal applied containing information as shown on the Drawings. The marker shall be the same color as the pipe being marked.

2.05 LINE STOPPING ASSEMBLIES

A. Sleeves used to line-stop existing mains shall be provided and installed at locations as shown on the Drawings. Line-stopping sleeve shall be steel fusion epoxy coated body with stainless steel straps, bolts, nuts, and washers. Contractor shall determine the outside diameter of the existing main prior to ordering sleeve.

B. The line-stopping equipment shall consist of a resilient sealing element, which shall be attached to and transported by a plug inserter perpendicularly into the pipe. The linear actuator shall extend and retract the Line-Stopper into and out of the pipe. When retracted from the pipe, the element and inserter shall be contained within the stopper housing.

C. The hollow cylindrical sealing element shall be molded of natural rubber. The lower interior chamber of the element shall be enlarged into a hemispherical cavity to allow symmetrical deformation into sealing conformity with the bore of the pipe.

D. The linear actuator shall be hydraulic and shall have a self-contained hand operated pump. The actuator shall exert a force sufficient to perpendicularly deform the cylindrical element into axially symmetrical sealing contact with the bore of the pipe. Design of actuator shall provide adequate stroke and means to continually align the line-stop bullet stopping assemblies in sizes 14-inch through 20-inch with pressure rating to 250-psig.

E. Equalization of pressure across the sealed element shall not be required to retract the element from the pipe. No equalization fittings shall be required downstream of the line-stopper.

F. The line-stopping equipment shall be accurately aligned on the 4-inch through 8-inch fittings by locating in the external threads of the fitting nozzle. With sizes 10-inch and 12-inch the location shall be made on the centering groove of the fitting flange.

G. Line-stopping equipment must be capable of function and acceptance of multiple stopper heads and shall be compatible with existing system fittings.

2.06 FIRE HYDRANTS AND VALVE ASSEMBLIES

A. Fire hydrants shall be 5-1/4-inch minimum valve opening and shall comply with the current AWWA Standard Specifications C502-54 for 150-psi working pressure. Fire hydrants shall be of ample length for 3-1/2-foot depth of bury with necessary extensions to place safety flange the required 3-inches above finished grade. Each hydrant shall be made in at least 2 sections bolted together. All interior working parts of the hydrant shall be removable form the top of the hydrant to allow repairs without removing the hydrant barrel after it has been installed. It shall be provided with 2 (two) 2-1/2-inch hose nozzles and 1 (one) 4-1/2-inch pumper nozzle, all having its specific Fire District Standard hose threads. All nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard. Drain or weep holes shall be permanently plugged by the manufacturer.

B. Fire hydrant painting and coating shall meet the requirements of Section 09900 "Painting." Fire hydrants shall be painted silver in accordance with the present Orange County standards.

Three (3) operating wrenches shall be furnished for every 10 hydrants installed or relocated.

C. All hydrant assemblies shall incorporate anchoring hydrant fittings, including M.J. Locked Hydrant Tee with split gland to provide the locking together of the entire assembly. Gate valve shall be as specified in Specification Section 15111 "Plug Valves."

D. All hydrants shall have a 24-inch to 48-inch square by 6-inch thick reinforced concrete shear paid as shown in the Drawings.

E. Fire hydrants shall be located in the general location as shown on the Drawings. Final field location of all hydrants shall be as approved by the County. All hydrants shall be located no less than 5 and no more than 10-feet from the edge of pavement of the adjacent roadway and no less than 5-feet from any physical feature which may obstruct access or view of any hydrant unless otherwise approved by the County.

2.07 SERVICE SADDLES

A. Stainless Steel Service Saddles: Shall be epoxy or nylon coated ductile iron body with stainless steel, 18-8 type 304 straps, AWWA tapered threads for 1-inch and 2-inch to be iron pipe threads. Controlled OD saddles to be used on C905 PVC pipe, double straps to be 2-inch minimum width each, single strap to be minimum of 3-inches wide.

B. PVC Pipe Service Saddle
   1. One-inch and 2-inch services utilize brass body saddle with controlled OD for 12-inches and smaller pipe.
   2. One-inch and 2-inch taps on existing pipes larger than 12-inches shall use controlled OD epoxy or nylon coated ductile iron body with stainless steel 18-8 type 304 straps.
   3. Four-inch or larger services shall be mechanical tapping sleeves.

C. Ductile Iron Pipe Service Saddle
   1. One-inch services shall be direct tapped.
   2. Two-inch service shall use a controlled OD service tapping saddle with stainless steel straps and a ductile iron body that is either nylon or epoxy coated
   3. Four-inch or larger services shall be mechanical tapping sleeves.

D. HDPE Pipe Service Saddle
   1. One-inch and 2-inch shall utilize controlled O.D. tapping saddle with epoxy or nylon coated stainless steel 18-8 type 304 double straps.
   2. Four-inch or larger, shall use wide body tapping sleeves with a broad cross section gasket set in a retaining groove that increases sealing capability as pressure increases.

E. Concrete Pressure Pipe Service Saddle
   1. Tapped concrete pressure pipe shall be in accordance with AWWA M-9, using a strap-type saddle made specifically for concrete cylinder pressure pipe.

F. Steel Pipe Service Saddle
   1. Welded-on steel sleeves shall be used for all sizes and applications.

2.08 CORPORATION STOPS AND CURB STOPS

A. Corporation Stops: Shall be brass body reduced port type compatible with the polyethylene tubing and threaded in accordance with AWWA C800, AWWA C901, and shall comply with NSF-61.

B. Curb Stops: Shall be brass body reduced port type compatible with the polyethylene tubing and threaded in accordance with AWWA C800, AWWA C901, and shall comply with NSF-61.

2.09 WATER MAIN AND RECLAIMED WATER MAIN SERVICE PIPE – N/A

2.10 PRESSURE GAUGES

A. Pressure gauges shall be installed on each pump station discharge pipe as indicated on the Drawings.

B. Pressure gauge shall be direct mounted, diaphragm (type) gauge, stainless steel case, stainless steel sensing element, liquid filled, with a 4-1/2-inch diameter dial and furnished with a clear glass crystal window and 1/4-inch shut-off (isolation) valve. Gauges shall be weatherproof.

C. The pressure gauge face dial shall be white finished aluminum with jet-black graduations and figures and shall indicate the units of pressure measured in psi. Gauges shall be provided with pressure at normal operation at the mid-range of the gauge.

D. As wastewater flows through the housing, the cylinder shall transmit pressure through the sensing liquid. Gauge outlet in the spool or ring shall be threaded, 1/4-inch, per ANSI B2.1.

E. Nipples for connecting gauges to piping shall be Schedule 80S, Grade TP 316 seamless stainless steel, conforming to ASTM A 312. Fittings shall conform to ASTM A 403, Class WP316. Threads shall conform to ANSI B2.1. Size of pipe nipple shall match the gauge connection size.

2.11 TIE RODS

A. Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A 123.

2.12 BACK FLOW PREVENTION

A. Reduced Pressure Backflow Preventer shall conform to the requirements of ASSE 1013, rated to 180°F and supplied with full port ball valves. The main body and access covers shall be bronze and meet ASTM B 584, the seat ring and all internal polymers shall be NSF Noryl and the seat disc elastomers shall be silicone.

B. Dual check valves shall be required and shall be accessible for maintenance without removing the relief valve or the entire device from the line.

C. The bottom of the preventer shall be installed a minimum of 12-inches above grade and not more than 30-inches above grade.

2.13 FLANGED COUPLING ADAPTERS

A. All adapters shall be harnessed with the bolts across the joint (flange to flange or flange to lug) designed for the pipe test pressure.

B. Adapter Size: Conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150-pound standard unless otherwise required for connections.

C. Exposed Sleeve Type
   1. Material: Steel
   2. Coating: Enamel
   3. Bolting: Carbon steel
   4. Acceptable Manufacturers: Dresser Manufacturing Co. - Style 128 for cast iron ductile iron and steel pipes with diameters of 2-inches through 96-inches, or equal.

D. Buried Sleeve Type
   1. Material: Cast iron
   2. Bolting: Type 304 stainless steel conforming to ASTM A 193, Grade B8 for bolts, and ATM A 194, Grade 8 for nuts and washers. Bolts and nuts greater than 1-1/8-inches shall be carbon steel, ASTM A 307, Grade B, with cadmium plating, ASTM A 165, Type NS.
   3. Acceptable manufacturers: Dresser Manufacturing Co. - Style 127 locking type for cast iron, ductile, iron, asbestos cement and steel pipes with diameters of 3-inches through 12-inches, or equal.

E. Split Type
   1. Material: Malleable or ductile iron.
   2. Design: For use with grooved or shouldered end pipe.
   3. Coating: Enamel
   4. Acceptable Manufacturers: Victaulic Company of America - Style 741 for pipe diameters of 2-inches through 12-inches, Victaulic Company of America - Style 742 for pipe diameters of 14-inches through 16-inches, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All ancillary equipment shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the

County before installation.

B. After installation, all ancillary equipment shall be tested as specified for adjacent piping. If any joint or equipment proves to be defective, it shall be repaired and retested to the satisfaction of the County.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures, which have a direct bearing on the location and shall be responsible for the proper location of these valves and appurtenances during the Construction of the structures.

D. Notification and Connections to Existing Mains
   1. The Contractor shall submit a completed "System Connection" form to the County to schedule the connection. The request shall be made a minimum of 5-working days prior to the proposed tie-in to the existing main for pressure connections and 10-working days prior to the proposed tie-in to the existing main for non-pressure connections. In this request, the Contractor shall provide the following information:
      a. Points of connection, fittings to be used and method of flushing and disinfection if applicable
      b. Estimated construction time for said connections
      c. Identify pressure and non-pressure connections
   2. Connections shall only be made on the agreed upon date and time. If the Contractor does not perform the Work in the agreed upon manner or schedule, the Contractor shall be required to reschedule the connection by following the procedure outlined above.

E. Pressure Connections: Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve, valve and machinery. Any damage to the main due to improper or insufficient supports will be repaired at the Contractor's expense.
   1. Prior to the tap, the Contractor shall assemble all materials, tools, equipment, labor, and supervision necessary to make the connection.
   2. The Contractor shall excavate a dry and safe working area pit of sufficient size to enable the necessary Work.
   3. The inside of the tapping sleeve and valve, the outside of the main and the tapping machine shall be cleaned and swabbed or sprayed with 1% liquid chlorine solution prior to beginning installation for water system pressure connections and must comply with AWWA C-651-99 or most current version.
   4. After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested under the observation of County personnel to 150-psi for 30-minute duration to ensure that no leakage will occur.
   5. For pressure connections 4-inch through 20-inch installation, the minimum diameter

cut shall be 1/2-inch less than the nominal diameter of the pipe to be attached. For larger taps, the allowable minimum diameter shall be 2 to 3-inches less than the nominal diameter of the pipe being attached. After the tapping procedure is complete, the Contractor shall submit the coupon to the County.

6. The tapping valve shall be placed horizontally for pressure connections to wastewater force mains. A plug valve shall be attached to the tapping valve after the tapping procedure is complete. The tapping valve shall be left in the open position prior to backfilling.
7. Adequate restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied.
8. The Contractor shall be responsible for properly backfilling the work area pit after the Work is completed.

F. Non-Pressure Dry Connections

1. For water service connections, no customer shall be without service for more than 6-hours. For wastewater connections, provide bypass operations per Section 01516 "Collection System Bypass." This accommodation to customers may include scheduling after Normal Working Hours.
2. The Contractor shall be ready to proceed by pre-assembling as much material as possible at the site to minimize the length of service interruption.
3. Needed pipe restraints must be installed prior to the initiation of the shutdown.
4. The excavation shall be opened and needed site preparations must be completed before the initiation of the connection work.
5. County shall postpone a service cut-off if the Contractor is not ready to proceed at the scheduled time.
6. Only County personnel shall operate the valves needed to perform the shutdown on the existing system.

3.02 - PAINTING

A. All exterior surfaces of iron body valves shall be clean, dry, and free from rust and grease before coating.

B. For valves installed underground or in valve vaults, all exterior ferrous parts of valve and actuator shall be coated at the factory with a thermally bonded epoxy coating in accordance with AWWA C550, latest revision.

C. For aboveground service, the exterior ferrous parts of all valves shall be coated in weatherproof paint. The color of the finish coats shall be in accordance with the Orange County Utilities Standards.

END OF SECTION

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SECTION 15105
CHECK VALVES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Scope of Work: Furnish, install, and test check valves including all appurtenances required as shown on the Drawings and as specified herein.

B. General Design
   1. Valves larger than 2-1/2-inch diameter shall meet or exceed the requirements of AWWA C-508.
   2. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of sewage, water, sludge, chemicals, air, etc., depending on the applications.
   3. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
   4. For all buried valves in which the operating nut is deeper than 4-feet from the finish ground surface, an extension rod with 2-inch operating nut and upper guide shall be installed permanently in the riser section. Extend nut to 1-foot below finish grade.

1.02 QUALITY ASSURANCE

A. All gate valves of same type and style shall be manufactured by one manufacturer.

B. All equipment furnished under this Specification shall be new and unused and shall be a standard product which has a successful record of reliable service in similar installations for a minimum of 5-years.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Shop Drawings and submittals shall be submitted to the County/Professional Engineer for review and acceptance prior to construction for the following:
   1. Certified Shop Drawings showing details of construction, dimensions (including laying length), and weight.

2. Descriptive literature, bulletins, and/or catalogs showing all valve parts and describing material of construction by material and specification, e.g., AISI.
3. Valve coatings and linings, if any.
4. A complete bill of materials for all equipment.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Shipping
1. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed.
2. Factory assembled parts and components shall be dismantled for shipment unless permission is received in writing from the County/Professional Engineer.
3. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built and securely bolted thereto.
4. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
5. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
6. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Storage
1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
2. Do not store valves or accessories directly on the ground.

C. Handling
1. Handle valves and accessories to prevent damage of any nature.
2. Carefully inspect all materials for:
a. Defects in workmanship and materials
b. Removal of debris and foreign material in valve openings and seats
c. Proper functioning of all operating mechanisms
d. Tightness of all nuts and bolts

1.05 WARRANTY AND GUARANTEES

A. The manufacturer's warranty period shall be concurrent with the Contractor's for 1-year, unless otherwise specified, commencing at the time of final acceptance by the County.

B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all equipment which lists for more than $500.00 (major equipment). The County reserves the right to request warranties for equipment not classified as "major". The Contractor shall still warrant equipment not considered to be "major" in the Contractor's 1-year warranty period even though certificates of warranty may not be required.

C. In the event that the equipment manufacturer or supplier is unwilling to provide a 1-year warranty commencing at the date of substantial completion, the Contractor shall obtain from the manufacturer a 2-year warranty commencing at the time of equipment delivery to the job site. This 2-year warranty from the manufacturer shall not relieve the Contractor of the 1-

year warranty starting at the time of County acceptance of the equipment.

D. The County shall incur no labor or equipment cost during the guarantee period.

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

PART 2 - PRODUCTS

2.01. MATERIALS AND EQUIPMENT

A. Ball Check Valves, 2-1/2-inches and smaller.
   1. Valves shall be all bronze construction with screwed ends.
   2. Minimum valve working pressure shall be 150-psi.
   3. Valves shall be as manufactured by Crane, Watts, or equal.

B. Rubber Flapper Swing Check Valves (Sewage/Sludge and Low Pressure Effluent Pumping Application; i.e., less than 50-psi).
   1. Valves shall have a cast iron body and cover meeting ASTM A126, Class B specifications.
   2. Flapper shall be Buna-N reinforced and shall be easily removed without any need to remove the valve from line.
   3. Ends shall be flanged, 125-pound ANSI B16.1. The flapper shall be Buna-N having an "O" ring seating edge and be internally reinforced with steel.
   4. Valve shall provide drip-tight shutoff.
   5. Each check valve shall be provided with an NEMA 4X limit switch mounted on the horizontal centerline of the body seat.
   6. Provide a manually operated backflow device which shall positively lock open flapper during full backflow.
   7. The FLEX portion of the disc shall have a 20-year warranty.
   8. Valves shall be manufactured by Apco Valve and Primer Corp., Series 100, Val-Matic Valve and Manufacturing Corp., Swing Flex, or equal.

C. Swing Check Valves
   1. Swing check valves shall conform to AWWA C508.
   2. The valve body shall be 2-piece cast iron conforming to ASTM A126 with flanged ends conforming to ANSI B16.1. The area throughout the valve body shall be equal to the full pipe area.
   3. The valve disc shall be ductile iron with bronze or resilient seating face. The disc shall be partially balanced with a short travel to resist slamming.
   4. The seat ring and disc ring shall be ASTM B763 Alloy 84400 bronze, with beveled edges, firmly clamped or screwed into the valve body. Seat rings and disc rings shall be field replaceable.
   5. The hinge pin shall be of stainless steel with bronze bushings, allow free movement of the disc without binding, and shall be guaranteed not to stick in the closed position.
   6. The valve shall be designed for a minimum working pressure of 150-psi.
   7. Valves shall be supplied with an outside lever and adjustable weight.

8. Valves 4-inches and larger shall be 8-mil epoxy lined.

D. Cushioned Swing Check Valves (Potable Water and High Pressure Effluent Application greater than 50-psi).
   1. All materials shall be as follows:

Table 15105-1 Materials of Construction		
PART	MATERIAL	ASTM or SAE
Body, Cover, Disc Disc Arm	Cast Iron Ductile Iron	A 126 GR.B A 536
Seat	Aluminum bronze or Stainless Steel	B 148 A 276
Seat Ring	Buna-N rubber or Metal	
Hinge Shaft	Stainless Steel	Type 303

   2. Valve body shall have integral flanges.
   3. The seat shall be centrifugally cast bronze with an o-ring seal and be locked in place with stainless steel lock screws and be field replaceable without the use of special tools.
   4. The shaft shall be single and continuous stainless steel, extending both sides of the body with a lever and weight, using a side-mounted air cushion cylinder.
   5. The air cushion cylinder shall be constructed of corrosion resistant material and the piston shall be totally enclosed. The cylinder assembly shall be externally mounted to the valve body and will permit adjustability to cushion the closure of the check valve.
   6. The valve shall prevent backflow of water on normal pump shut-off or power failure and shall be watertight.
   7. A valve position indicator and micro switch shall be provided to remotely indicate open/close position of check valve.
   8. Valve body area shall equal or exceed the full pipe area.
   9. Valve shall be Series 6,000 air cushioned swing check valve as manufactured by APCO or acceptable equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install valves and accessories in strict accordance with manufacturer's instructions and recommendations, as shown on the Drawings and/or as directed by the County.

B. Carefully erect all valves and support them in their respective positions free from distortion and strain.

C. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.

D. Support all valves connected to pumps and equipment, and in piping systems that cannot support valves.

E. Repair any scratches, marks and other types of surface damages, etc., with original prime coating as supplied by the factory.

F. Apply finish coating in accordance with Division 9.

3.02 DEMONSTRATION AND TESTING

A. Demonstration, start-up (adjustment) and testing shall demonstrate that all valves have been properly installed and that check valves operate properly.

END OF SECTION

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SECTION 15111
GATE VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish and install gate valves of the type and size and in the locations as shown on the Drawings and/or specified herein.

B. General Design
   1. Resilient seat non-rising stem (NRS) gates valves shall be used for underground service and for aboveground service where shown on the Drawings.
   2. Resilient seat Outside Stem and Yoke (OS&Y) gate valves shall be used for aboveground service only where shown on the Drawings.

1.02 QUALITY ASSURANCE

A. All gate valves of same type and style shall be manufactured by one (1) manufacturer.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Shop Drawings and submittals shall be submitted to the County/Professional Engineer for review and acceptance prior to construction for the following:
   1. Certified Shop Drawings showing details of construction, dimensions (including laying length), and weight.
   2. Descriptive literature, bulletins, and/or catalogs showing all valve parts and describing material of construction by material and specification, e.g., AISI.
   3. Valve coatings and linings, if any.
   4. A complete bill of materials for all equipment.
   5. See individual sections for additional requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Shipping
   1. All parts shall be properly protected so that no damage or deterioration will occur

during a prolonged delay from the time of shipment until installation is completed.

2. Factory assembled parts and components shall be dismantled for shipment unless permission is received in writing from the County/Professional Engineer.
3. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built and securely bolted thereto.
4. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
5. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
6. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Storage
   1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
   2. Do not store valves or accessories directly on the ground.

C. Handling
   1. Handle valves and accessories to prevent damage of any nature.
   2. Carefully inspect all materials for:
      a. Defects in workmanship and materials.
      b. Removal of debris and foreign material in valve openings and seats.
      c. Proper functioning of all operating mechanisms.
      d. Tightness of all nuts and bolts.

1.04 WARRANTY AND GUARANTEES

A. The manufacturer's warranty period shall be concurrent with the Contractor's for 1-year, unless otherwise specified, commencing at the time of final acceptance by the County.

B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all equipment which lists for more than $500.00 (major equipment). The County reserves the right to request warranties for equipment not classified as "major". The Contractor shall still warrant equipment not considered to be "major" in the Contractor's 1-year warranty period even though certificates of warranty may not be required.

C. In the event that the equipment manufacturer or supplier is unwilling to provide a 1-year warranty commencing at the date of substantial completion, the Contractor shall obtain from the manufacturer a 2-year warranty commencing at the time of equipment delivery to the job site. This 2-year warranty from the manufacturer shall not relieve the Contractor of the 1-year warranty starting at the time of County acceptance of the equipment.

D. The County shall incur no labor or equipment cost during the guarantee period.

E. Guarantee shall cover all necessary labor, equipment, and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and

materials, leakage, breakage, or other failure of equipment or components furnished by the manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MATERIALS

A. Gate valves shall be resilient seat gate valves, manufactured to meet or exceed the requirements of AWWA C509/C515, latest revision, and these Specifications. All valves are to be tested in strict accordance with AWWA C509/C515.

B. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

C. The minimum design working water pressure shall be minimum 250-psig.

D. Gate valves shall be installed vertically per the Drawings and with minimum depth of cover per Table 15111-1.

Table 15111-1
Minimum Pipe Cover Required for Valves

Pipe Diameter (Inches)	Vertical Gate Valve Cover	
	LOCAL Roadway	Non-LOCAL Roadway*
4-inch – 8-inch	30-inch	36-inch
12-inch	36-inch	36-inch
16-inch	44-inch	48-inch
20-inch	-	50-inch
24-inch	-	54-inch
* Additional 12-inches of cover is required for all vertical valves 16-inches and greater located in the pavement		

E. Valves 16-inches and larger shall be AWWA C515 resilient seated only (16-inches through 24-inches no gearing required).

F. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B for C509 valves and ductile iron ASTM A536 for C515 valves. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating in accordance with AWWA C 550.

G. A 2-inch wrench nut shall be provided for operating the valve. Valves 30-inches and larger shall be provide with spur gear actuators. Side actuated gate valves are not acceptable. All valves shall open left or counter clockwise.

H. The valves shall have non-rising stems with the stem made of cast, forged, or rolled bronze

as specified in AWWA C509. Two (2) stem seals shall be provided and shall be of the O-ring type. The stem nut must be independent of the gate.

I. The resilient sealing mechanism shall provide zero leakage at test and normal working pressure when installed with the flow from either direction.

J. Tapping valves shall be placed vertical where possible for Water and Reclaimed Water. When tapping existing mains, valves 24-inches and above shall be furnished with NPT pipe plugs for flushing the tracks.

K. All materials shall be in accordance with Appendix D "List of Approved Products."

PART 3 - EXECUTION

3.01 PREPARATION

A. All valves shall be inspected upon delivery in the field to insure proper working order before installation. Valves shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All buried gate valves shall be connected using restrained joints. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the County before installation.

3.02 INSTALLATION

A. Install valves and accessories in strict accordance with manufacturer's instruction and recommendations as shown on the Drawings and as directed by the County.

B. Carefully erect all valves and support them in their respective positions free from distortion and strain.

C. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.

D. Support all valves connected to pumps and equipment and in piping systems that cannot support valves.

E. Repair any scratches, marks and other types of surface damage with original coating as supplied by the factory.

F. Valves shall be carefully inspected, opened wide and then tightly closed and the nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Any valve that does not operate correctly shall be

removed and replaced.

3.03 INSPECTION AND TESTING

A. Check and adjust all valves and accessories for smooth operation.

B. Test valves for leakage at the same time that connecting pipelines are tested. See Section 02660 "Potable Water Systems" for pressure testing requirements. Protect or isolate any parts of valves, operators, or control and instrument systems whose pressure rating is less than the pressure tests.

END OF SECTION

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SECTION 15119

ELECTRIC MOTOR ACTUATORS

PART 1 – GENERAL

1.01 SECTION INCLUDES

This section includes materials and installation of electric motor operators for valves.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 09900 - Painting and Coating

C. Section 10400 – Identifying Devices

D. Section 02660 – Potable Water Systems

E. Section 16150 - Motors

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Submit manufacturers catalog data showing motor operator parts and materials of construction, referenced by AISI, ASTM, SAE or CDA specification and grade. Show motor operator dimensions, weights and coatings.

C. Show the maximum torque required to open and close each motor operated valve. Maximum torque shall include seating or unseating torque, bearing torque, dynamic torque and hydrostatic torque. Assume that the differential pressure across the valve is equal to the valve pressure rating.

D. Submit electrical schematic drawings and physical wiring diagrams showing all components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The valve electric operators shall be Rotork Fluid Systems (IQ, , IQTF) or Flowserve Corp. Limitorque (MX-05 ”A” Series).

2.02 OPERATOR IDENTIFICATION

A. Motorized valves are identified on the drawings by the asset number beginning with the

prefix “MOV.”

B. Motorized valves shall have the name of the manufacturer cast or molded onto the body or shown on a permanently attached plate in raised letters.

2.03 OPERATOR TAGGING

A. Provide identifying tags for electric motor operated valves per Section 10400. Show valve gate operator asset number, name, size and designation as shown on the drawings. Attach tags to operators by means of stainless steel or copper wire.

2.04 MOTORS FOR ELECTRIC OPERATORS

A. Motors shall be Type 3AEM per Section 16150 except that they will be 480 volts, 3 phase. Motors shall be specifically designed and rated for frequent jogging and reversing service. Output capacity shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions.

B. Contacts shall be provided which can be selected to indicate any position of the valve. Provision shall be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during handwheel operation when all external power to the actuator is isolated. The contacts shall be rated for 5mA to 5A, 120V AC, 30V DC. The Contacts shall be selectable to signal one of the following:

1. Valve Open Command
2. Valve Close Command
3. Valve Position Open
4. Valve Position Closed
5. Valve in Remote
6. Actuator Fault

C. Actautor to be operational from SCADA when place in Remote and shall be operational in local.

D. Provide potentiometer mounted on the switch mechanism to provide source of signal for position indication.

E. Provide a monitor relay with alarm contacts to sense loss of motor supply, loss of control signal, motor local/remote switch set to local.

F. Provide relay with alarm contacts to sense incorrect phase rotation or loss of one phase.

2.05 OPERATOR TORQUE REQUIREMENTS

A. The output torque of the motor operator shall be at least 1.5 times the maximum torque

required to open or close the valve at any position. Each motor operator shall have ample power capacity for accurately seating, unseating and positioning the valve when subjected to the most severe operating condition including any mechanical friction and/or other restrictive conditions that are inherent in the valve assembly. Coordinate with the valve manufacturer to assure that the motor operator torque output does not exceed the torque limits of the valve operating shaft.

2.06 DESIGN OF ELECTRIC MOTOR OPERATORS

A. Design the operators for valves MOV-1, MOV-2 and MOV-3 to move the valves from fully open to fully closed in one minute.

B. Each electric operator shall contain a reversing magnetic starter, three overloads (one in each ungrounded leg), 480/120-volt control power transformer, local/remote selector switch, stop-open-close pushbuttons, and open and closed indicator lights. The control housing shall be NEMA 4 construction with threaded hubs for conduit entry. Provide a separate local/remote selector switch, stop-open-close pushbuttons, and open and closed indicator lights within the Pump Control Panel (PCP).

C. Operator housings, supports and connections to the valve shall be designed with a minimum safety factor of five based on the ultimate strength or three based on the yield strength of the material used.

D. Gearing: Shall be double-reduction, with a helical gear and pinion forming the first reduction and a worm and worm gear forming the second. The helical gear and pinion shall be fabricated from heat-treated alloy steel with hobbed and finished shaved teeth. The worm shall be fabricated from heat-treated alloy steel, ground, carburized and hardened. The worm gear shall be fabricated from high tensile strength bronze with hobbed teeth. The stem nut shall be fabricated from high tensile strength bronze and shall be the two-piece type, when possible. It shall be possible to remove the stem nut from rising stem operators from the top without removing the operator from the valve or gate, disconnecting any electrical wiring, or disassembling any of the gearing.

2.07 MANUAL OPERATOR

A. Electric operators shall be provided with a handwheel for manual operation. The handwheel shall not rotate during motor operation nor shall a locked motor prevent manual operation. Motor or manual selection shall be accomplished by a positive declutching knob or lever which will disengage the motor and motor gearing mechanically but not electronically. It shall not be possible for the unit to be in manual and motor operation simultaneously. Hand operation shall not require more than 100 pounds of rim effort at maximum torque.

2.08 HAMMER BLOW DEVICE

A. Electric operators shall be provided with a built-in lost-motion device that allows sufficient travel of the worm gear, prior to engaging the stem nut, for the motor to reach full speed. This action shall impart a “hammer blow” to start the valve or gate in motion in either direction. The load shall be shared equally by two lugs cast integrally on the drive sleeve.

PART 3 - EXECUTION

3.01 STARTUP AND TESTING

A. Start-up Services: The actuator manufacturer's representative shall perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements.

B. The tests shall include system capacity and all control functions.

C. When any defects are detected, correct defects and repeat test.

D. The County will observe startup and testing of selected equipment. Coordinate the startup and contractor testing schedules with the County. Provide a minimum of 7 days notice to the County prior to startup and testing.

END OF SECTION

SECTION 15145
PLUMBING PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES
- A. Pipe, pipe fittings, valves, and connections for piping systems.
  1. Sanitary sewer.
  2. Domestic water.

1.02 RELATED REQUIREMENTS
- A. Section 09900 - Paints and Coatings.

1.03 SUBMITTALS
- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
- D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.
- E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.
- F. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE
- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS
- A. Do not install underground piping when bedding is wet or frozen.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 SANITARY SEWER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.05 CHEMICAL RESISTANT SEWER PIPING

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2729 or ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.06 WATER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Joints: AWS A5.8/A5.8M, BCuP copper/silver braze.

2.07 WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Joints: AWS A5.8/A5.8M, BCuP copper/silver braze.

2.08 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type M (C), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.
3. Joints: Grooved mechanical couplings.

2.09 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
1. Ferrous pipe: Class 150 malleable iron threaded unions.
2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch (25 mm):
1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, or galvanized.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F (minus 29 degrees C to 82 degrees C).
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
a. Grinnell Products, a Tyco Business: www.grinnell.com.
b. Shurjoint Piping Products, Inc., a Tyco Business;www.shurjoint.com.
c. Nibco, Inc; www.nibco.com
d. Approved Equal

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.10 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.
5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
a. Bases: High density polypropylene.

b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
4. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
4. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.

2.11 BALL VALVES

A. Manufacturers:
1. Conbraco Industries: www.apollovalves.com.
2. Grinnell Products, a Tyco Business: www.grinnell.com.
3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
4. Nibco, Inc; www.nibco.com.
5. Milwaukee Valve Company: www.milwaukeevalve.com.

2.12 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. Hammond Valve: www.hammondvalve.com.
2. Crane Co.: www.cranevalve.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Approved Equal.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
G. Provide access where valves and fittings are not exposed.
H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
I. Provide support for utility meters in accordance with requirements of utility companies.
J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.
K. Install bell and spigot pipe with bell end upstream.
L. Install valves with stems upright or horizontal, not inverted.
M. Install water piping to ASME B31.9.
N. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
O. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
P. Sleeve pipes passing through partitions, walls and floors.
Q. Inserts:
    1. Provide inserts for placement in concrete formwork.
    2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
    3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
    4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
    5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
R. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.
B. Install unions downstream of valves and at equipment or apparatus connections.
C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
E. Install ball valves for throttling, bypass, or manual flow control services.
F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.
G. Provide spring loaded check valves on discharge of water pumps.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot (1:50) slope.
B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.
B. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
E. Maintain disinfectant in system for 24 hours.
F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary sewer services to connect to the on-site waste holding tank. Before commencing work check invert elevations required for connection to the waste holding tank, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves. Refer to Section 02510 for backflow preventer specifications.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
2. Provide 18 gage (1.20 mm) galvanized sheet metal sleeve around service main to 6 inch (150 mm) above floor and 6 feet (1800 mm) minimum below grade. Size for minimum of 2 inches (50 mm) of loose batt insulation stuffing.

3.08 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
   a. Pipe size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
      1) Maximum hanger spacing: 6.5 ft (2 m).
      2) Hanger rod diameter: 3/8 inches (9 mm).
   b. Pipe size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
      1) Maximum hanger spacing: 10 ft (3 m).
      2) Hanger rod diameter: 3/8 inches (9 mm).
   c. Pipe size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
      1) Maximum hanger spacing: 10 ft (3 m).
      2) Hanger rod diameter: 1/2 inches (9 mm).
   d. Pipe size: 4 inches (40 mm) to 6 inches (50 mm):
      1) Maximum hanger spacing: 10 ft (3 m).
      2) Hanger rod diameter: 5/8 inches (15 mm).
   e. Pipe size: 8 inches (200 mm) to 12 inches (300 mm):
      1) Maximum hanger spacing: 14 ft (4.25 m).
      2) Hanger rod diameter: 7/8 inches (22 mm).
   f. Pipe size: 14 inches and Over (350 mm and Over):
      1) Maximum hanger spacing: 20 ft (3 m).
      2) Hanger rod diameter: 1 inches (25 mm).
2. Plastic Piping:
   a. All Sizes:
      1) Maximum hanger spacing: 6 ft (1.8 m).
      2) Hanger rod diameter: 3/8 inches (9 mm).

END OF SECTION

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SECTION 15146
PLUMBING SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES
- A. Floor drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Backflow preventers.
- F. Water hammer arrestors.

1.02 SUBMITTALS
- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
- D. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- F. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, None.

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS
- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS
- A. Manufacturers:
  1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
  2. Josam Company: www.josam.com.
  3. LATICRETE Inernational, Inc.; LATICRETE® HYDRO BAN® Linear Drain: www.laticrete.com.
  4. LATICRETE Inernational, Inc.; LATICRETE® HYDRO BAN® Bonding Flange Drain: www.laticrete.com.
  5. Noble Company; FreeStyle Linear Drain: www.noblecompany.com.
  6. Zurn Industries, Inc: www.zurn.com.
  7. Approved Equal.

- B. Floor Drain (FD-2):

1. ASME A112.6.3; galvanized cast iron or stainless steel, two piece body with double drainage flange, weep holes, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

2.03 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Josam Company: www.josam.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Approved Equal.
B. Cleanouts at Exterior Surfaced Areas (CO-1):
   1. Round cast nickel bronze access frame and non-skid cover.
C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
D. Cleanouts at Interior Finished Floor Areas (CO-3):
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
E. Cleanouts at Interior Finished Wall Areas (CO-4):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Watts Regulator Company: www.wattsregulator.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Approved Equal.
B. Interior Hose Bibbs:
   1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in conformance with ASSE 1011.
C. Interior Mixing Type Hose Bibbs:
   1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with handwheels, and vacuum breaker in conformance with ASSE 1011.

2.05 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Conbraco Industries: www.apollovalves.com.
   2. Watts Regulator Company: www.wattsregulator.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Approved Equal.
B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third

check valve that opens under back pressure in case of diaphragm failure; non-threaded bent outlet; assembled with two gate valves, strainer, and four test cocks.

2.06 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:
   1. Conbraco Industries: www.apollovalves.com.
   2. Watts Regulator Company: www.wattsregulator.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Approved Equal.

B. Double Check Valve Assemblies:
   1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories.

H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch (20 mm) minimum, and minimum 18 inches (450 mm) long.

END OF SECTION

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SECTION 15410
PLUMBING FIXTURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Service sinks.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in County's name and registered with manufacturer.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 – PRODUCTS

2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 TANK TYPE WATER CLOSETS

A. Tank Type Water Closet Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com.
2. Gerber Plumbing Fixtures LLC: www.gerberonline.com.
3. Kohler Company: www.kohler.com.
4. Zurn Industries, Inc: www.zurn.com.
5. Approved Equal.

B. Bowl: ASME A112.19.2; floor mounted, siphon jet, vitreous china, 16.5 inches high, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps.
   1. Water Consumption: Maximum 1.6 gallon per flush.

C. Seat Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Bemis Manufacturing Company: www.bemismfg.com.
   3. Church Seat Company: www.churchseats.com.
   4. Olsonite: www.olsonite.com.
   5. Approved Equal.

D. Seat: Solid white plastic, open front, extended back, less cover, complete with self-sustaining hinge.

E. Handle Height: 44 inches or less.

2.03 LAVATORIES

A. Lavatory Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Gerber Plumbing Fixtures LLC; www.gerberonline.com.
   3. Kohler Company: www.kohler.com.
   4. Zurn Industries, Inc: www.zurn.com.
   5. Approved Equal.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, 18 by 20 inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.
   1. Drilling Centers: 4 inch

C. Supply Faucet Manufacturers:
   1. American Standard, Inc; SERIN Monoblock Faucet: www.americanstandard-us.com.
   2. Kohler Company: www.kohler.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Approved Equal.

D. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), single lever handle.

E. Accessories:
   1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   2. Offset waste with perforated open strainer.
   3. Wheel handle stops.
   4. Flexible supplies.
   5. Carrier:
      a. Manufacturers:
         1) JOSAM Company: www.josam.com.
         2) Zurn Industries, Inc: www.zurn.com.
         3) American Standard, Inc: www.americanstandard-us.com.
         4) Kohler Company: www.kohler.com

5) Approved Equal.

2.04 SERVICE SINKS

A. Service Sink Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Commercial Enameling Company: www.cecosinks.com.
   3. Elkay Manufacturing Company: www.elkay.com.
   4. Gerber Plumbing Fixtures LLC; www.gerberonline.com.
   5. Just Manufacturing Company: www.justmfg.com.
   6. Zurn Industries, Inc; www.zurn.com.
   7. Approved Equal.

B. Bowl: ASME A112.19.1; 22 by 18 by 12 inch (560 by 460 by 300 mm) deep, porcelain enameled (inside only) cast iron roll-rim sink, with 12 inch (300 mm) high back, concealed hanger, chrome plated strainer, stainless steel rim guard, cast iron P-trap with adjustable floor flange.

C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Accessories:
   1. 5 feet (1.5 m) of 1/2 inch (13 mm) diameter plain end reinforced plastic hose.
   2. Hose clamp hanger.
   3. Mop hanger.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
B. Verify that electric power is available and of the correct characteristics.
C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.
B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
C. Install components level and plumb.
D. Install and secure fixtures in place with wall carriers and bolts.
E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.
B. Do not permit use of fixtures by construction personnel.
C. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
    1. Water Closet:
        a. Standard: 15 inches (380 mm) to top of bowl rim.
        b. Accessible: 18 inches (455 mm) to top of seat.
    2. Lavatory:
        a. Standard: 31 inches (785 mm) to top of basin rim.
        b. Accessible: 34 inches (865 mm) to top of basin rim.
B. Fixture Rough-In
    1. Water Closet (Tank Type):
        a. Cold Water: 1/2 Inch (15 mm).
        b. Waste: 4 Inch (100 mm).
        c. Vent: 2 Inch (50 mm).
    2. Lavatory:
        a. Hot Water: 1/2 Inch (15 mm).
        b. Cold Water: 1/2 Inch (15 mm).
        c. Waste: 1-1/2 Inch (40 mm).
        d. Vent: 2 Inch (50 mm)
    3. Service Sink:
        a. Cold Water: 3/4 Inch (19 mm).
        b. Waste: 3 Inch (80 mm).
        c. Vent: 2 Inch (50 mm).

END OF SECTION

SECTION 15731
SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Air cooled condensing units.

B. Indoor air handler (fan & coil) units for duct connection.

C. Controls.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

D. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

E. Design Data: Indicate refrigerant pipe sizing.

F. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

G. Project Record Documents: Record actual locations of components and connections.

H. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

I. Warranty: Submit manufacturer’s warranty and ensure forms have been filled out in County s name and registered with manufacturer.

J. Maintenance Materials: Furnish the following for County's use in maintenance of project.

1. See Section 01630 - Product Selection and Substitution Procedures for additional provisions.
2. Extra Filters: One for each unit.

1.03 WARRANTY

A. See Section 01700 – Project Closeout, for additional warranty requirements.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Trane Inc: www.trane.com.

C. York International Corporation / Johnson Controls: www.york.com.

D. Approved Equal.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating: None.
   2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
   3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.
   1. Efficiency:
      a. Energy Efficiency Ratio: 13.
      b. Comply with ASHRAE Std 90.1.
   2. Air Handling:
      a. Air Flow: 2000 cfm.
   3. Cooling Performance Requirements:
      a. Evaporator Cooling Output: 60000 Btuh.
      b. Air Temperature Entering Evaporator:
         1) Dry Bulb: 75 degrees F.
         2) Wet Bulb: 67 degrees F.
      c. Outdoor Unit Rated Cooling Output: 60000 Btuh.
      d. Condenser Ambient Air Temperature: 95 degrees F.

C. Electrical Characteristics:
   1. 460 volts, single phase, 60 Hz.
   2. 15 amperes maximum overcurrent protection.
   3. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 16155.

2.03 INDOOR UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Counterflow, with additional steel base.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
   2. Motor Electrical Characteristics:
      a. 1 hp
      b. 460 volts, single phase, 60 Hz.

C. Air Filters: 1 inch (25 mm) thick disposable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Comply with AHRI 210.
   2. Refrigerant: Use only refrigerants that have ozone depletion (ODP) of zero and global warming potential (GWP) of less than 50.
   3. Refrigerant: R-410A.
   4. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   5. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
   6. Sound Rating: 69 dBA, when measured in accordance with AHRI 270.

B. Compressor: AHRI 520; hermetic, two speed 1800 and 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: ARI 520; Aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
   1. Condenser Fans: Direct-drive propeller type.
   2. Condenser Fan Motor: Enclosed, 3-phase, permanently lubricated.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes

E. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

F. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig (1965 kPa) and off when pressure drops below 140 psig (965 kPa) for operation to 0 degrees F (-18 degrees C).

G. Mounting Pad: Precast concrete pad minimum 6 inches wider than condenser foot print; center condenser on pad.

2.05 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. System selector switch (heat-off-cool) and fan control switch (auto-on).
   2. Automatic switching from heating to cooling.

3. Preferential rate control to minimize overshoot and deviation from setpoint.
4. Set-up for four separate temperatures per day.
5. Instant override of setpoint for continuous or timed period from one hour to 31 days.
6. Short cycle protection.
7. Programming based on weekdays, Saturday and Sunday.
8. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
9. Battery replacement without program loss.
10. Thermostat display:
    a. Time of day.
    b. Actual room temperature.
    c. Programmed temperature.
    d. Programmed time.
    e. Duration of timed override.
    f. Day of week.
    g. System mode indication: heating, cooling, fan auto, off, and on, auto or on, off.
11. Manufacturers:
    a. Carrier Corporation: www.carrier.com.
    b. Trane Inc: www.trane.com.
    c. York International Corporation / Johnson Controls: www.york.com.
    d. Approved Equal.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

D. Verify that water supply is available for humidifier.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

D. Pipe drain from air handler condensate connection to nearest drywell.

END OF SECTION

SECTION 15810
DUCTS

PART 1 – GENERAL

1.01 SECTION INCLUDES
- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Casing and plenums.
- D. Duct cleaning.

1.02 SUBMITTALS
- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials.
- C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.
- D. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.
- E. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements.
- F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.03 REGULATORY REQUIREMENTS
- A. Construct ductwork to NFPA 90A standards.

1.04 FIELD CONDITIONS
- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 – PRODUCTS

2.01 DUCT ASSEMBLIES
- A. All Ducts: Galvanized steel, unless otherwise indicated.
- B. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
- C. Return and Relief: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
- D. General Exhaust: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

2.02 MATERIALS
- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
   4. For Use With Flexible Ducts: UL labeled.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
   6. Other Types: As required.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.

C. Duct systems have been designed for metal duct. At the Contractor's option, fibrous glass duct may be substituted for metal duct.

D. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

E. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

F. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Slab Duct Ventilation System: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS, with G90/Z275 coating designed for installation in cast-in-place concrete floor assemblies.
   1. Fittings: Elbows, End caps, Connecting couplings, Spin-in-collar, Sofit-discharge head, Support Brackets, and Wall discharge head

B. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   3. Maximum Velocity: 4000 fpm (20.3 m/sec).
   4. Temperature Range: Minus 10 degrees F to 160 degrees F (Minus 23 degrees C to 71 degrees C).

C. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 4 inches WG (1000 Pa) positive and 0.5 inches WG (175 Pa) negative.
   4. Maximum Velocity: 4000 fpm (20.3 m/sec).
   5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).

D. Flexible Ducts: Multiple layers of aluminum laminate supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   4. Maximum Velocity: 4000 fpm (20.3 m/sec).
   5. Temperature Range: Minus 20 degrees F to 210 degrees F (Minus 28 degrees C to 99 degrees C).

E. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   3. Maximum Velocity: 4000 fpm (20.3 m/sec).
   4. Temperature Range: Minus 20 degrees F to 210 degrees F (Minus 28 degrees C to 99 degrees C).

F. Flexible Ducts: UL 181, Class 0, interlocking spiral of aluminum foil.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 8 inches WG (2.0 kPa) positive or negative.
   3. Maximum Velocity: 5000 fpm (25.4 m/sec).
   4. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 99 degrees C).

2.05 FIBROUS GLASS DUCTS

A. Fibrous Glass Ducts: 1 inch (25 mm) thick rigid glass fiber with aluminum foil, glass scrim and Kraft or plastic jacket vapor barrier; maximum 0.23 K value at 75 degrees F (0.034 KSI at 24 degrees C).
   1. UL labeled to UL 181.

B. Fabricate in accordance with SMACNA Fibrous Glass Duct Construction Standards, except as indicated.

C. Machine fabricate fibrous glass ducts and fittings. Make only minor on site manual adjustments.

D. Staple duct joints and tape with 3 inch (75 mm) wide 2 mil (0.05 mm) thick or 2 inch (50 mm) wide 3 mil (0.75 mm) thick aluminum pressure sensitive tape, UL approved.

E. Staple duct joints and tape with 2-1/2 inch (63 mm) wide pressure sensitive tape, UL approved.

F. Staple duct joints and tape with 3 inch (75 mm) wide heat activated chemical bonding tape.

G. Do not use fibrous glass ducts within 12 inches (300 mm) of electric or fuel fired heaters.

H. Maximum stress exerted on structural steel members: 22000 psi (152 MPa).

I. Maximum temperature: 250 degrees Fahrenheit (121 degrees Celsius).

J. Conform to safety standards NFPA 90A and 90B.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Fibrous Glass Ducts: Install in accordance with SMACNA Fibrous Glass Duct Construction Standards. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.

E. Flexible Ducts: Connect to metal ducts with mechanical fastener

F. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

J. Use double nuts and lock washers on threaded rod supports.

K. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

L. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

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SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 16 sections in addition to Division 1 - General Requirements.

1.02 GENERAL CONDITIONS FOR ALL WORK

A. All Work must closely be coordinated among the electric utility, the construction manager, and the County.

1.03 SCOPE OF WORK

A. Provide the electrical utility service to the site as indicated on the contract documents. All work must comply with Duke Energy of Florida, Inc. (DE) requirements. Contractor is responsible for all coordination with DE. Contractor to coordinate with the Progress Energy representative:

Mr. Andre C. Williams
Distribution Engineer
Duke Energy – BV
3250 Bonnet Creek Road
P.O. Box 10,000
Lake Buena Vista, Florida 32830
407-938-6685

B. Provide empty conduit with pull string for service to the site as indicated on the contract documents.

C. Provide complete electrical system for the proposed I-Drive Potable Water Booster Pump Station including but not limited to:

1. Meter Can
2. Main Breaker
3. Motor Control Center
4. Pump Control Panel
5. Cable Trays
6. Variable Frequency Drives with Reduced Voltage Solid State Starters
7. Transformer
8. Panelboard
9. Motor Starters
10. Gate Control System

D. Provide conduits to serve the electrical system as shown on the drawings:

E. Provide surge suppressors where indicated on the drawings.

F. Provide site grounding, lightning protection and lighting.

G. Provide all breaking settings, testing and startup services.

H. Each bidder or his authorized representatives shall, before preparing a bid, visit all areas of the proposed site in which work will take place and be performed to inspect carefully the present conditions. The submission of the bid by this bidder shall be considered evidence that the bidder has visited the project and noted the locations and conditions under which the work will be performed and that the bidder takes full responsibility for a complete knowledge of all factors governing his work.

I. All necessary temporary power, control and instrumentation requirements are the responsibility of the Contractor and s hall be furnished at no extra cost to the County. Power and controls shall be furnished to all existing equipment at all times.

J. Pay all fees required for permits, inspections, and connections.

1.04 REFERENCES

A. ANSI/NFPA70-National Electrical Code.

1.05 SUBMITTALS

A. Include products specified in the following sections:

1. Section 16100 – Raceways, Boxes and Cabinets
2. Section 16120 – Wires and Cables
3. Section 16150 – Motors
4. Section 16160 – Panelboards
5. Section 16195 – Electrical Identification
6. Section 16370 – Variable Frequency Drives
7. Section 16450 – Grounding System
8. Section 16476 – Disconnects and Circuit Breakers
9. Section 16482 – 480V Motor Control Centers
10. Section 16500 – Lighting Systems
11. Section 16709 – Surge Protection

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

C. Mark dimensions and values in units to match those specified.

D. Indicate applicable specification section on each submitted document.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable Building Codes for project location.

B. Electrical: Conform to NFPA 70 - 2011 Edition.

C. Occupational Safety and Health Administration (O.S.H.A.).

D. Utility company rules and regulations.

E. Obtain permits and request inspections from authority having jurisdiction.

1.07 COORDINATION, SHORT CIRCUIT AND FLASH ARC HAZARD STUDY

A. General:

1. The Contractor shall provide a Power System Study and Flash Arc Study for the electrical power distribution and motor control equipment. The studies shall be a totally independent effort to verify adequacy of all equipment being implemented under these Specifications. The studies shall be prepared, signed and sealed by a professional Engineer, registered in the State of Florida, with demonstrated experience in the performance of industrial power system and fault arc hazard analysis. The Engineer may be an employee of an equipment manufacturer or supplier.

2. The Contractor shall provide data necessary to perform the study. This includes feeder cable sizes, approximate feeder length motor data, existing protective relay settings and any other information relevant to the study.

3. A summary of the short circuit analysis shall be provided to the Contractor at the time shop drawings for all of the new equipment is submitted for approval.

4. The Contractor shall provide complete sets of motor control center shop drawings for use in the studies.

5. The Contractor shall submit SKM Source files with the study to the engineer for review and approval.

B. Scope:

1. The short circuit study shall be in accordance with ANSI Standard C37.010 and C37.13, shall be performed to check the adequacy, and to verify the correct application of circuit protective devices and other system components specified. The study shall address the case when the system is being powered from the normal source as well as from the on-site generating facilities. Minimum as well as maximum possible fault conditions shall be adequately covered in the study.

2. Fault contribution of all motors shall be considered. The Contractor shall be responsible for obtaining all required data of equipment. All back-up calculations shall become part of the final report. The calculations shall be in sufficient detail to allow easy review.

3. The flash arc analysis study shall include the calculations of flash protection boundary limits and the incident energy exposure for the maximum arc producing flash expected from the electrical equipment. The study will determine incident energy exposure level and flash arc protection boundaries for the electrical equipment, based on IEEE-1584 and NFPA-70E. The study shall be based on the protective device settings and interrupting device clearing time.

C. Contents:

1. The study shall include representation of the power company's system, the base quantities selected, impedance source-data, calculation methods and tabulations, one-line and impedance diagrams, conclusions and recommendations. Short-circuit momentary duties, shall be calculated on the basis of an assumed bolted three-phase short circuit at the main breaker, ATS, 480 volt motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the systems. The short circuit tabulations shall include significant X to R ratios, asymmetry factors, KVA, and symmetrical fault current.

2. A protective device time current coordination study shall be included with coordination plots of key and/or limiting devices, tabulated data, rating, and/or settings selected. The study shall present an Engineering balance between the competing objectives of protection and continuity of service for the system specified, taking into account the basic factors of sensitivity, selectivity and speed.

3. Separate plots shall be provided for each mode, "normal," and, "standby," operation. Maximum fault values shall be shown in each case. Both power sources shown in one plot will not be accepted.

4. Existing protective device settings in key locations shall be reviewed to ensure selectivity under the new conditions. Recommended changes shall be indicated in the report. The Contractor shall be made aware of the required changes immediately.

5. Required settings for breakers and relays shall be maximized to provide the most effective protection possible whether the system is fed from the normal or emergency source.

6. Tabulations indicating recommended set points for all protective devices shall be provided. This shall include the normal as well as the emergency source.

7. Flash Arc study shall include representation of the calculation methods and tabulations, and a one-line drawing of all identifying equipment included in this study. The complete study shall be turned over to the County as per 01420. as part of the study, the Contractor shall affix permanent adhesive

non-fading labeling indicating the equipment ID number and required information as required by NFPA 70E.

D. Motor Current-Time Characteristic Curves:

1. A complete independent set of current-time characteristic curves for all 480 volt motor drives indicating coordination between the protective relays and the thermal characteristics of the motor shall be provided.

2. The Contractor shall obtain from the motor supplier, the necessary information to perform the study. Certified curves for, "Safe time vs. current at 100 percent voltage," and "Accelerating time vs. current at 100 percent voltage," shall become part of the final report.

E. Motor Starting Study:

1. A motor starting study for all large electric drives to determine voltage dip or power inrush limitations at selected locations due to starting of motors shall be provided. This applies to both the normal and the emergency mode.

F. General Information for Time-Current Curves Presentation:

1. The coordination plots shall include complete titles, representative one-line diagrams, legends, associated power company's relay or system characteristics, significant motor starting characteristics, complete parameters for power, and substation transformers, and complete operating bands for low-voltage circuit breaker trip devices.

2. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, time-dial settings and pickup settings required.

3. The short-time region shall indicate the medium voltage relay instantaneous elements, the magnetizing in-rush, and ANSI withstand transformer parameters, the low-voltage circuit breaker instantaneous trip devices, fuse manufacturing to tolerance bands, and significant symmetrical and asymmetrical fault currents.

4. Each primary protective device required for a delta-to-wye connected transformer shall be selected so that the characteristic or operating band is within the transformer parameters; which, where feasible, shall include a parameter equivalent to 58 percent of the ANSI withstand point to afford protection for secondary line-to-ground faults.

5. Low-voltage power circuit breakers shall be separated from each other and the associated primary protective device, where feasible, by a 16 percent current margin for coordination and protection in the event of secondary line-to-line faults.

6. Protective relays shall be separated, where feasible, by a 0.3 second time margin when the maximum three-phase fault flows, to assure proper selectivity.

1.08 CONDUIT DRAWINGS

A. In addition to the manufacturer's equipment shop drawings, the CONTRACTOR shall submit for approval, electrical installation working drawings for the pump station building and the site electrical containing the following:

1. Concealed and buried conduit layouts shown on floor plans drawn at not less than 1/4-inch = 1-foot-0-inch scale. The layouts shall include locations of process equipment, motor control centers, transformers, panelboards, control panels and equipment, motors, switches, motor starters, large junction or pull boxes, instruments, and any other electrical devices connected to concealed or buried conduits.

2. Plans shall be drawn on high quality reproducible, , size 36-inch x 24-inch, and shall be presented in a neat, professional manner.

3. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit complete operations and maintenance data for all equipment furnished under this Division in accordance with Section 01340 manuals shall be prepared specifically for this installation and shall include all required cuts, Drawings, equipment lists, descriptions, complete part lists, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.10 WARRANTY

A. Provide a warranty for all the electrical equipment in accordance with the requirements of other sections, but in no case less than three (3) years from date of substantial completion.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Electrical systems shall be complete and operable for the intended purpose in accordance with applicable codes at the time of acceptance.

B. The Contractor shall coordinate all activities with the construction manager and the County.

END OF SECTION

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SECTION 16100

RACEWAYS, BOXES AND CABINETS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Provide submittals for all electrical equipment enclosures.

1.02 REFERENCES

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Comply with NECA "Standard of Installation."

1.03 LISTING AND LABELING

A. Provide products specified in this Section that are UL listed and labeled.

PART 2 - PRODUCTS

2.01 CONDUIT

A. Liquid Tight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

B. PVC Conduit and Tubing Fittings: NEMA TC 3; Schedule 80, match to conduit or conduit/tubing type and material.

C. Aluminum Rigid Conduit

2.02 BOXES

A. Outlet and Device Boxes: Use 1 of the following:

1. Nonmetallic Boxes: NEMA OS2.

B. PWI and Junction Boxes: Use 1 of the following:

1. Small Boxes: NEMA OS 1, stainless steel.

2. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

C. Hinged Cover Enclosures: Stainless steel enclosure with continuous hinge cover and flush latch. The enclosure shall be provided with stainless panel insert for mounting equipment. Outdoor enclosures shall be 316 NEMA 4X Stainless Steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Seal all outdoor raceways using duct seal.

B. Use the following wiring methods:

1. Exposed: Rigid Aluminum

2. Underground: PVC Schedule 80 Concrete encased.

3. Instrumentation (shielded cable): Aluminum or PVC (dependent on location)

4. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquid tight flexible metal conduit.

5. Boxes and Enclosures:

a. 316 NEMA 4X stainless steel. All hardware shall be stainless steel.

C. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

D. Install raceways level and square and at proper elevations. Provide adequate headroom.

E. Complete raceway installation before starting conductor installation.

F. Use temporary closures to prevent foreign matter from entering raceway.

G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

H. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated keep the legs of a bend in the same plane and the straight legs of offsets parallel.

I. Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1-inch (25 mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in the concrete.

3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.

J. Install underground raceways:

1. At least 18" below grade.
2. At least 24" below driveways and roads.
3. All buried ductbanks to be concrete encased 3000 psi color red concrete.

K. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.

2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

L. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

2. Use insulating bushings to protect conductors.

M. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

N. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

O. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb (90kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.

P. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling, threaded inside for plugs, and set flush with the finished floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.

Q. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

R. Install hinged cover enclosures and cabinets plumb. Support at each corner.

S. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

END OF SECTION

SECTION 16120

WIRES AND CABLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable, and appurtenances as shown on the Drawings and as hereinafter specified.

1.02 SUBMITTALS

A. Samples of proposed wire and cable shall be submitted for approval. Each sample shall have the size, type of insulation, UL listing and voltage stenciled on the jacket.

B. Approved samples will be sent to the project location for comparison by the Resident Engineer with the wire actually installed.

C. Installed, unapproved wire shall be removed and replaced at no additional cost to the County.

1.03 APPLICATIONS

A. Wire for lighting and receptacle circuits above grade shall be type THWN.

B. Wire for all Non-VFD power motor circuits and below grade lighting and receptacle circuits shall be type RHW or XHHW, stranded.

C. Wire for all service conductors shall be type RHW or XHHW, stranded.

D. Single conductor wire for control, indication and metering shall be type MTW No. 14 AWG, 19 strand or type THHN No. 14 AWG stranded.

E. Multi-conductor control cable shall be No. 14 AWG, 19 strand.

F. Wire for process instrumentation or shielded control cable shall be No. 16 AWG, shielded and stranded.

G. Wire for all VFD output power cable shall be type SLPE RHH/RHW-2. See Section 2.05 of this specification for additional requirements.

H. All shielded cable shall have a #12 ground wire.

1.04 MINIMUM SIZES

A. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All wires and cables shall be of annealed, 98 percent conductivity, soft drawn stranded copper conductors.

2.02 600 VOLT WIRE AND CABLE

A. Type RHW and XHHW shall be cross-linked polyethylene (XLP); as manufactured by the Southwire Co., Collyer Insulated Wire Co., Rome Cable or approved equal.

B. Type THWN shall be as manufactured by the Southwire Co., Collyer Insulated Wire Co., Rome Cable or approved equal.

2.03 INSTRUMENTATION AND CONTROL CABLE

A. Process instrumentation wire shall be twisted pair, 600V, cross-linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or approved equal. Multi-conductor cables shall be supplied with individually shielded twisted pairs.

B. Multi-conductor control cable shall be stranded, 600V, cross-linked polyethylene insulated with PVC jacket, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or approved equal.

2.04 TERMINATIONS AND SPLICES

A. Power Conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors per termination. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors. Heat shrink boots shall be utilized for all outdoor splices.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): Terminations permitted shall be typical of control conductors. Splices are allowed at instrumentation terminal boxes only.

D. Except where otherwise approved by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices <u>shall not</u> be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.

2.05 VARIABLE FREQUENCY DRIVE (VFD) OUTPUT POWER CABLE

A. Section applies to power cables routed between the output of VFD's and motor terminals.

B. Cable shall be rated for 2000 volts and shall meet the requirements below:

1. Conductors shall be stranded Class B bare copper.
2. All wire shall be brought to the job in unbroken packages and shall bear the data of manufacturing; not older than 12 months.
3. Type of wire shall be XLPE RHH/RHW-2 rated 90 degrees C suitable for wet locations.
4. Provide overall 5 millimeter metallic shield (copper tape shield) overlapped 50%.
5. No wire smaller than No. 12 gauge shall be used unless specifically indicated.
6. Cable construction shall consist of three insulated current-carrying phase conductors and three bare ground conductors, symmetrically placed between the phase conductors, and twisted beneath a continuous overall PVC polymeric jacket.

C. Each ground conductor size (circular mil area) shall be one-third (1/3) of the NEC required size (circular mil area) for a single ground conductor. If one third of the required circular mil area does not correspond to a standard size (circular mil area) of construction, the next largest size of standard construction shall be used. All conductors shall be megger tested after installation and insulation must be in compliance with the Insulated Power Cable Engineers Association Minimum Values of Insulation Resistance.

D. Manufacturers:
1. General Cable
2. Southwire
3. Approved Equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at one end only, as directed by supplier of the instrumentation equipment.

F. Wire and cable connections to terminals and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or approved by the Engineer as the manufacturer of the particular item of wire and cable.

H. Steel fish tapes and/or steel pulling cables shall not be used in PVC conduit runs.

I. All control and instrumentation circuits and wiring shall be clearly and permanently numbered and labeled at each end so as to identify the location of the opposite end and the function of the circuit. Individual wires in a multi-wire circuit shall be identified with wire numbers. Labeling shall be in place prior to turnover of any equipment, system or sub-system to County.

3.02 TESTS

A. Main service and motor feeders 600-volt wire insulation shall be tested with a meg-ohmmeter after installation. Tests shall be made at not less than 1,000 VDC.

B. All service conductors shall be tested as in paragraph A above. These tests shall be witnessed by the Engineer. A written report shall be submitted to the engineer for review.

END OF SECTION

SECTION 16150

MOTORS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

1.02 QUALIFICATIONS

A. Motor shall be sufficient size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.

1.03 SUBMITTALS

A. The motor manufacturer shall submit to the Engineer certified dimension prints showing nameplate data and outline dimensions within three weeks of the date they receive the order.

B. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and improper installation for a period of one year from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the Contractor at no expense to the County.

C. Provide equipment warranty in accordance with the County's requirements for Warranties and Bonds.

PART 2 – PRODUCTS

2.01 RATING

A. Unless otherwise noted, all motors shall be of the low voltage type. All motors 1/2 through 100 horsepower shall be rated 230/460 volt, 3 phase, 60 Hertz A.C.; motors 125 horsepower through 500 horsepower shall be rated 460 volt, 3-phase, 60 Hertz, and motors below 1/2 horsepower shall be rated 115/230 volt, 1 phase, 60 Hertz A.C.

2.02 THREE PHASE INDUCTION MOTORS

A. Motors 20 HP and larger shall have a 120-volt space heater for moisture control.

B. Unless specifically noted in other sections of these Specifications, all motors shall have a minimum as indicated in the table below. All motors shall be "premium efficiency" type.

TABLE 1

Motor HP	Min. Eff.	Max. dba	Motor HP	Min. Eff.	Max. dba
1-2	84.0%	74	25-30	92.0%	92
3-5	86.5%	79	40-50	93.0%	97
7.5-10	90.2%	84	60-75	94.0%	100
15-20	91.0%	89	100	94.1%	102

C. Motors operating with variable frequency drives shall state that they are suitable for their intended applications. Motor nameplate shall read "Inverter Duty Rated".

D. Motors larger than 100 Hp and operating with a VFD shall have imbedded a winding temperature switch.

E. Motors 300 Hp and larger shall have vibration protection.

2.03 CONSTRUCTION

A. General:

1. All dripproof and weather protected Type I motors shall have epoxy encapsulated windings. Totally enclosed motors shall not be encapsulated. Motors not readily available with encapsulated windings may be standard type. Motors exposed to the outside atmosphere shall be totally enclosed fan cooled (TEFC) unless otherwise specified.

2. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.

B. Low Voltage, Three Phase Motors:

1. Motors shall be of the squirrel-cage or wound rotor induction type as noted. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as specified herein. All motors shall be built in accordance with current NEMA, IEEE, ANSI and AFBMA standards where applicable. Motors shall be of the type and quality described by these Specifications, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.

2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.

3. Motors shall be totally enclosed fan-cooled construction with 1.15 service factor unless otherwise noted. Indoor motors shall be WPI unless otherwise

noted.

4. Motors shall be suitable for operation in moist air with hydrogen sulfide gas present.

5. The output shaft shall be suitable for direct connection or belt drive as required.

6. Motors shall have a Class B nonhygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.

7. All motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.

8. All fittings, bolts, nuts, and screws shall be 316 stainless steel. Bolts and nuts shall have hex heads.

9. All machine surfaces shall be coated with rust inhibiter for easy disassembly.

10. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.

11. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.

12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

13. Low voltage, three phase motors shall be manufactured by General Electric, U.S. Motors, Westinghouse or approved equal.

14. Fractional Horsepower:

    a. Fractional horsepower motors shall be rigid, welded-steel, designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.

    b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.

    c. For light to moderate loading, bearings shall be quiet all-angle sleeve type with large oil reservoir that prevents leakage and permits motor

operation in any position.

d. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large reservoir providing 10 years' normal operation without relubrication.

15. Integral Horsepower:

a. Motor frames and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.

b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

d. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings may be cast-aluminum or bar-type construction with brazed end rings.

e. Motors shall be equipped with vacuum-degassed antifriction bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

f. Bearings of high thrust motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum B10 life rating of 100,000 hours in accordance with AFBMA life and thrust values.

g. Vertical hollow-shaft motors will have nonreverse ratchets to prevent backspin.

C. Low Voltage, Single Phase Motors:

1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm called for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open dripproof, or totally enclosed fan cooled as called for on the Drawings, with temperature rise in accordance with NEMA Standards for Class B insulation.

2. Totally enclosed fan cooled motors shall be designed for severe-duty.

3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have a corrosion protective plating.

4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Motor Connections: All motors shall be connected to the conduit system by means of a short section 18-inch minimum of flexible conduit unless otherwise indicated. For all motor connections, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

3.02 TESTS AND CHECKS

A. The following tests shall be performed on all motors after installation but before putting motors into service.

1. The Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor. The following table gives minimum acceptable insulation resistance in megohms at various temperatures and for various voltages with readings being taken after one minute of megger test run.

TABLE 2

Degree Winding Temperature		**Voltage**			
^{o}F	**^{o}C**	**115V**	**230V**	**460V**	**4,160V**
37	3.9	60	108	210	1,700
50	10	32	60	120	1,000
68	20	13	26	50	460
86	30	5.6	11	21	195
104	45	2.4	4.5	8.8	84
122	50	1	2	3.7	35
140	60	.5	.85	1.6	15

2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication, and shall lubricate if required in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

B. The following tests shall apply to the medium voltage motors:

1. See Paragraph 2.03 B.2 for test requirements.

2. All motors shall be given the standard short commercial test prior to shipment. This shall consist of no load current, check current balance, winding resistance, air gap measurement, high potential tests, and bearing inspection. Six (6) copies of the certified short commercial test shall be mailed to the Engineer prior to shipment.

END OF SECTION

SECTION 16160

PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor materials, equipment and incidentals required and install all panelboards as hereinafter specified and as shown on the Drawings.

PART 2 - PRODUCTS

2.01 RATING

A. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

B. Panelboards installed indoors shall be NEMA 4X SS type enclosure unless otherwise noted. Panelboards to be stainless steel.

C. Panelboards installed outdoors shall be NEMA 4X SS type enclosure unless otherwise noted.

2.02 STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

2.03 CONSTRUCTION (NEMA 4X SS)

A. Interiors:

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the antiturn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A nameplate shall be provided listing panel type, number of circuit breakers and ratings.

B. Buses:

1. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

4. Buses for 120/208V light panels shall be rated 10,000 amperes RMS symmetrical.

C. Boxes:

1. Recessed boxes shall be made from galvanized code gauge steel without multiple knockouts. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides.

2. Surface mounted boxes shall have an internal and external finish as hereinafter specified in paragraph D4.

3. At least 4 interior mounting studs shall be provided.

4. All conduit entrances shall be field punched.

D. Trim:

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48-in in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

3. The trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4-inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

E. Manufacturer:

1. 120/240V, single phase, 3-wire, and 120/208V 3-phase, 4-wire panelboards shall be as manufactured by Square D or equal.

2. 480V, 3-phase, 3-wire panelboards shall be as manufactured by Square D or equal.

2.04 CIRCUIT BREAKERS:

A. Panelboards shall be equipped with circuit breakers as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-in type.

C. Circuit breakers used in 120/240 and 120/208V panelboards shall have an interrupting capacity of not less than 10,000 - amperes, RMS symmetrical.

D. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Drawings. GFCI units shall be 1 pole, 120 volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity of 10,000 amperes RMS.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2-inch air space between the box and the wall.

B. Unless otherwise noted on the Drawings, top of cabinets shall be mounted 6-feet 0-inch above the floor, properly aligned and adequately supported independently of the connecting raceways.

C. All wiring in panelboards shall be neatly formed, grouped, laced, and identified to provide a neat and orderly appearance. A typewritten directory card identifying all circuits shall be placed in the cardholder inside the front cover.

END OF SECTION

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

C. Color coding.

1.02 SCOPE

A. Provide engraved nameplates for the following equipment as indicated on the drawings:

1. Label all compartments.
2. Label all outdoor junction boxes.
3. Label control system panels.

B. All wires shall be marked and color-coded.

C. All control wiring shall have wire numbers on each end.

D. All exposed conduits to be painted to match color of back wall.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.

B. Wire and Cable Markers: Pre-printed self-sticking type.

C. Color Coding Tape: Vinyl plastic insulating tape, colors as specified in part 3.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Degrease and clean surfaces to receive nameplates and tape labels.
B. Install nameplates and tape labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure

nameplate to inside face of recessed panelboard doors in finished locations.

3.02 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

B. Any color coding schemes used in existing work shall be maintained in new work.

C. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

240/120 Volts	120/208 Volts	Phase	480/277 Volts
Black	Black	A	Brown
Red	Red	B	Orange
Blue	Blue	C	Yellow
White	White	Neutral	White
Green	Green	Ground	Green

3.03 NAMEPLATE ENGRAVING

A. Provide nameplates to identify all electrical distribution and control equipment and loads served. Letter Height: 1/8 inch for individual switches and loads served for distribution and control equipment identification.

B. Panelboards, Switchboards and Motor Control Centers: 1/4 inch; identify equipment designation. 1/8 inch; identify voltage rating and source.

C. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 1/8 inch; identify circuit and load served, including location.

D. Individual Circuit Breakers, Enclosed Switches, and Motor Starters: 1/8 inch; identify load served.

END OF SECTION

SECTION 16370

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install variable frequency drives as shown on the Drawings and as specified herein.

B. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, the shop tests, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for the variable frequency drives herein specified.

1.02 DESCRIPTION OF SYSTEM

A. The variable frequency drives shall be furnished by the Contractor. The Contractor is responsible for complete system operation and necessary coordination.

B. The variable frequency drives will operate motors as specified in Division 11. The drives furnished herein under shall be totally compatible and adequately sized with both the Pumps and Motors to be supplied.

C. VFDs shall be sized as shown on the Drawings. All variable frequency drive systems shall be 18 pulse minimum. VFD's shall be sized to serve 115% of motor full load amps at 480 volts, 3-Phase.

1.03 QUALIFICATIONS

A. Variable speed drives shall be sized to operate the ampacity shown on the electrical drawings. To assure unit responsibility, all equipment specified in this section of the specifications shall be furnished and coordinated by the CONTRACTOR. The CONTRACTOR shall be responsible for coordinating the sizing of all VFDs.

B. The drives covered by these Specifications are intended to be equipment of proven ability as manufactured by reputable manufacturers having long experience in the production of identical units. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

C. The variable frequency control shall operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10% total harmonic voltage distortion and commutation notches up to 36,500 volt microseconds, or when other variable frequency drives are operated from the same bus.

Individual or simultaneous operation of the variable frequency drives shall not add more than 5% total harmonic voltage distortion to the normal bus, nor more than 10% while operating from standby generator (if applicable) per IEEE 519, latest edition. The load side of the utility transformer shall be the point of common coupling (PCC). The short circuit current at point of common coupling under utility operation is approximately 50,000 symmetrical amperes at 277/480 volts. A harmonic (voltage and current) analysis must be submitted by the variable frequency drive manufacturer with shop drawings. This must include all calculations, simply a statement of compliance is not acceptable. Voltage and current harmonics compliance per IEEE 519 shall be verified by the variable frequency drive manufacturer with field measurements of the harmonic distortion difference at the point of common coupling with and without variable frequency drives operating. See testing requirements.

D. The variable frequency drive manufacturer shall maintain and staff engineering service and repair shops through the United States, including the State of Florida, trained to do start up service, emergency service calls, repair work, service contracts and training of customer personnel.

E. The variable frequency drives shall be manufactured by Square D, Cutler Hammer or Allen Bradley.

F. Provide Ethernet module for each VFD for monitoring of parameters.

1.04 SUBMITTALS

A. Copies of all materials required to establish compliance with the specifications shall be submitted. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. Data on the characteristics and performance of the variable frequency drives. Data shall include certification that the variable frequency drives are warranted for use with the motors specified in Division 11 and Division 16.

4. Complete drawings shall be furnished for approval before proceeding with manufacture and shall consists of master wiring diagrams, elementary or control schematics including coordination with other electrical control devices operating in conjunction with the variable frequency drive, and suitable outline drawings with sufficient details for locating conduit stub-ups and field wiring. Generic schematics not specific to this project shall not be acceptable.

5. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List

bearings by the bearing manufacturer's numbers only.

1.05 OPERATING INSTRUCTIONS

A. Three copies of the operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

B. A factory representative who has complete knowledge of proper operation and maintenance shall be provided for one (1) day after completion of all training to instruct representatives of the County on proper operation and maintenance.

1.06 TOOLS AND SPARE PARTS

A. One (1) set of all special tools required for normal operation and maintenance shall be provided. If no special tools are required then a statement to this effect shall be provided.

B. Contractor shall supply the following spares:
   1. One (1) spare VFD rated for 124 amps minimum
   2. One (1) can of touch up paint for the enclosures

1.07 PRODUCT HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and spare parts must be properly protected against any damage during a prolonged period at the site.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.08 WARRANTY

A. A factory-authorized service technician shall perform start-up on each drive. ("Startup" shall not include installation or termination of either power or control wiring.) Start-up costs provided with the bid shall include time and travel for the estimated number of visits required, but shall not be less than at least one half-day with travel. Additional labor or return trips to the site shall be billed at the VFD supplier’s published straight-time rates. The rates shall be submitted with the VFD shop drawings. Upon completion, a start-up service report shall be provided.

B. All equipment supplied under this Section shall be warranted by the equipment

manufacturers for a period of five (5) years, parts and labor from date of substantial completion. The County shall not be responsible for any warranty costs including travel, labor, parts, or other costs for a full 5 years from the date of manufacture of the Drive. The warranty shall cover all Drive failures including lightning strikes. The cost of the warranty shall be included in the bid.

PART 2 - PRODUCTS

2.01 GENERAL

A. The CONTRACTOR shall furnish complete variable frequency drive systems for installation by the Contractor. The CONTRACTOR is responsible for the startup of all VFD drives furnished on this project.

B. The Contractor shall be responsible for the erection and installation of all equipment defined in this section of the contract documents.

C. The variable frequency drive shall comply with the latest applicable standards of ANSI, NEMA, IEEE, and the National Electrical Code.

D. Variable frequency drive shall operate as specified on standby generators or normal power sources.

E. The CONTRACTOR shall provide a listing of all programmable parameters that are different from the factory default values. For each indicate:

1. The factory default and meaning
2. The revised value and meaning

F. The CONTRACTOR shall provide a copy of PC compatible remote programming/ diagnostic software and any required cables to the supplier of the control system. Refer to Division 13. The software shall be able to communicate to the VFDs via an ethernet network connection.

G. Reduced Voltage Solid State Starter Bypass:

1. Reduced voltage starter shall be combination solid state motor controller with circuit breaker (Allen Bradley SMC Plus or Square D). Starters shall be “Heavy Duty” type.
2. Starters shall be provided with isolation and full voltage bypass contactors with overloads. Selector switch shall be on WPCP inner door. AIC rating shall be 25,000 amps.
3. Motor starter shall have a 120-volt operating coil, overload relay in each phase and control power transformer.
4. Motor starter shall have 1-N.O. and 1-N.C. auxiliary contacts. Additional auxiliary contacts shall be furnished where shown on the Drawings or as required by the control scheme.
5. Overload relays shall be adjustable and manually reset by push button in

compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.

6. Control power transformer shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.
7. Motor circuit protector shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with solid state reduced voltage starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits.
8. The following options shall be required:
    - Soft start
    - Soft stop
    - Protective module - line side of each starter

2.02 CONSTRUCTION

A. Each variable frequency drive shall consist of a 460V, 3-phase rectifier, DC link and variable frequency inverter with features, functions and options as specified. The inverter shall be voltage source design using pulse width modulation (PWM) techniques.

B. The variable frequency drives shall be rated for continuously operating at 1.15 times the full load current of the motor. The variable frequency drives shall be designed to provide continuous speed adjustment of three-phase motors. The variable frequency output voltage shall provide constant volts-per-Hertz excitation to the motor terminals up to 60 Hertz.

C. Inverters shall be capable of converting incoming three phase, 460V (+10 to -10%) and 60 Hertz (+/-2) Hertz power to DC bus levels. The DC voltage shall be inverted to a variable frequency output.

D. Controllers shall be rated for an ambient temperature of 0^{o}C to 40^{o}C and humidity of 0 to 95% non-condensing.

E. VFDs shall have complete front accessibility. All VFD openings shall be filtered.

F. The following standard basic control features shall be provided on the inverter:

1. Start, Stop, "Power On" indicating light and speed control potentiometer. Terminations for remote mounted operator control devices shall be furnished.
2. Unidirectional operation, coast to rest upon stop.
3. Variable linear independent timed acceleration.
4. Variable torque performance from 4 to 60 Hertz.
5. Frequency stability of 2% for 24 hours with voltage regulation of +2% of maximum rated output voltage.
6. LCD status indication for Power On, Run, Inverter Enable, Overcurrent, Overvoltage, Overtemperature, Low Supply, and Phase Loss.
7. 115V AC control power for operator devices.
8. Phase insensitive to input power.

9. Automatic restart upon return of power following a utility outage. Drive shall require manual reset after three (3) attempts in a 60 second period.

G. The following protective features shall be provided on the drive:

1. Input AC circuit breaker with an interlocked, pad lockable handle mechanism and AC input line current limiting fuses for fault current protection of AC to DC converter section and circuit breaker. Minimum short circuit rating of 65,000 AIC shall be provided.
2. Electronic overcurrent trip for instantaneous overload protection.
3. Undervoltage and phase loss protection of output.
4. Over-frequency protection.
5. Over-temperature protection.
6. Surge protection from input AC line transients.
7. Electrical isolation between the power and logic circuits, as well as between the 115V AC control power and the static digital sequencing.
8. Drive to be capable of withstanding output terminal line short or open circuits without component failure.
9. di/dt and dv/dt protection for converter semiconductors.
10. Units shall have an English language (no codes) alphanumeric diagnostic display. LED indication of over frequency, instantaneous overcurrent, DC over voltage, AC undervoltage/loss-of-phase, emergency stop, overload, over temperature, inverter pole trip and standby modes shall be provided and door mounted. Additional door mounted status indicating LEDs for self-diagnostic including run, phase loss, micro-processor fault, as well as board mounted LEDs including one for each inverter pole gating signal, each inverter pole status and each logic level VDC used. A comprehensive microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions is also approved.

H. The following standard independent adjustments shall be provided on the inverter:

1. Minimum speed (12 to 54 HZ).
2. Maximum speed (40 to 60 HZ).
3. Acceleration time 6 to 60 Sec. (minimum).
4. Deceleration time 6 to 60 Sec. (minimum).
5. Volts per Hertz.
6. Stability adjustment, if required.
7. Voltage boost (100 to 600 percent of nominal V/HZ ratio at 1 HZ tapering to 100 percent at 20 HZ).

I. The following shall be furnished with each controller:

1. Isolated process instrument speed input signal of 4-20 mA DC.
2. Isolated process instrument speed output signal 4-20 mA DC.
3. Relay output auxiliary contacts as shown on the drawings or as required herein, in Division

4. Door-mounted output load ammeter, voltmeter, and speed output indicating meters.
5. Built-in self-diagnostics.
6. Relay output auxiliary contacts as shown on the drawings.
7. Local/Off/Remote and Start/Stop selector switches.
8. Input line reactors.
9. Input filter if required for IEEE519 compliance.
10. All openings in the VFD shall be filtered.
11. Supply an Ethernet connection to access operating parameters and data, power, temperature, voltages and currents to be polled by IFIX.

J. The Variable Frequency Drive shall allow Ethernet communications.

1. The embedded web server shall contain web-pages that provide the ability to configure, control, monitor and diagnose the AC drives via Internet Explorer. No additional software shall be required.
2. The embedded web-pages must be secured by use of a customizable User Name and Password.

K. The Ethernet Communications Card shall support the following services via the standard ethernet Port 502:

1. TCP/Modbus Client, with support for periodic I/O Scanning
2. HTTP Server for drive configuration, control, and monitoring.
3. ICMP client to support certain IP services such as the "ping" command.
4. BOOTP client to assign an IP Address via an address server.
5. FTP Server for modifying, deleting or creating embedded web pages

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Field wiring shall be in accordance with manufacturer's recommendations. Anchor bolts shall be stainless steel and set in accordance with the manufacturer's recommendations. VFD motor leads shall be in rigid conduit. Each VFD shall have its own rigid conduit for its motor leads. Motor leads shall not be mixed with any other wiring. See VFD manufacturer’s instruction manuals for detailed directions on installation of the VFD’s and the installation of the motor leads.

3.02 SPARE PARTS

A. Contractor to include a $5000.00 Allowance for the County to select spare parts from the manufacturers list of recommended spare parts. List to include all recommended spare parts with pricing.

3.03 SHOP PAINTING

A. Prior to shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill/scale, rust, grease, dirt, and other foreign matter.

B. Drives shall be shop painted.

3.04 TESTING

A. Tests and Check

1. The drive manufacturer shall test the drive controller with a motor load prior to shipment. The motor shall have equal or greater full load current than the specified motor.
2. A certified copy of all tests and checks performed in the field, complete with meter readings and recordings, where applicable, shall be submitted to the County.

B. The SYSTEM SUPPLIER shall provide the services of a competent and experienced equipment manufacturer's factory field engineer to supervise start-up and provide training to the County's personnel. The factory field engineer shall be available for one (1) - eight (8) hour day to inspect the installed equipment and supervise the start-up demonstration and testing as specified in Section 01650: Start-up, and additional testing and training as specified herein. The factory field engineer shall be available for two (2) additional eight (8) hour days (a total of three (3) - eight (8) hour days) to provide factory and on-site training to the County's personnel as specified herein. Training of the County's personnel will only be considered valid for approval by the Engineer if it takes place after the successful start-up and demonstration test.

3.05 TRAINING

A. The cost of training programs to be conducted with County's personnel shall be included in the Contract price. The training and instruction, insofar as practicable, shall be directly related to the System being supplied. The Supplier shall provide $3,000.00 worth of factory training. Classes to be selected by the County.

B. The Supplier shall provide classroom training detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

C. The Supplier shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, such materials shall be delivered to County.

D. The training program shall represent a comprehensive program covering all aspects of the variable frequency drive and maintenance of the system.

E. All training schedules shall be coordinated with, and at the convenience of the County. Shift training may be required to correspond to the County's working schedule.

F. On-site Training: Additional on-site (field) training shall be conducted at the County's Plant Site and shall provide detailed hands-on instruction to County's personnel covering: system debugging, program modification, trouble-shooting, maintenance procedures, calibration procedures, and system operation. On-site training for general plant staff shall be conducted over a period of one day.

3.06 START UP SERVICES

A. The supplier shall provide start up services for the VFDs to the Contractor. A minimum of two days and two trips shall be provided.

END OF SECTION

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SECTION 16450

GROUNDING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

1.02 RELATED WORK

A. Conduit shall be as specified under Section 16100.

B. Wire shall be as specified under Section 16120.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ground rods: Ground rods shall be copperclad steel 3/4-inch x 20 foot. Ground rods shall be Copperweld or be an approved equal product.

PART 3 - EXECUTION

3.01 GENERAL

A. The service entrance equipment ground bus shall be grounded to a 3/4-inch cold water pipe, to the ground grid and to the building steel. The protecting conduits shall be bonded to the grounding conductor at both ends. The Contractor shall not allow the water pipe connections to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

B. Ground bus in all motor control centers shall be connected to the service entrance equipment ground bus with a No. 3/0 conductor.

C. All steel building columns shall be bonded together and connected to the building ground grid and to the service entrance ground with a No. 1/0 copper conductor. The bond wire for all high service pumps shall be connected to the high service pump casing via Cadweld.

D. Conduits stubbed-up below a motor control center shall be fitted with insulated grounding bushings and connected to the motor control center ground bus. Boxes mounted below motor control centers shall be bonded to the motor control center ground bus. The grounding wire shall, unless otherwise indicated on the drawings, be sized in accordance with Table 250-122 of the National Electrical Code, except that a minimum No. 12 AWG shall be used.

E. Lighting transformer neutrals shall be grounded to a grounding electrode and the service entrance ground.

F. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

G. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and similar items shall be grounded.

H. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or approved equal. All buried connections shall be made by welding process equal to Cadweld.

I. For reasons of mechanical strength, grounding conductors extending from the facility grounding grid to the ground buses of motor control centers shall be No. 3/0 AWG.

J. The facility grounding grid conductors shall be embedded in backfill material around the structures.

K. All underground conductors shall be laid slack and where exposed to mechanical injury shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

L. The Contractor shall exercise care to insure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.02 TESTS

A. The Contractor shall test the ground resistance of the system. The Engineer shall be notified forty-eight (48) hours before tests are made to enable the County to have designated personnel present. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment. The Contractor shall submit all grounding system test results to the Engineer for review.

END OF SECTION

SECTION 16476

DISCONNECTS, TRANSFORMERS AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SCOPE

A. Circuit breakers for panelboards.

B. Molded case circuit breakers for motor control centers.

C. Fusible and Non-Fusible safety switches.

1.02 SUBMITTALS

A. Submit product data according to the Conditions of the Contract and Division 1 Specification Sections.

1.03 REFERENCES

A. Comply with NFPA 70 “National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the “National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.01 SWITCHES

A. Enclosed Non-fusible Switch: NEMA KS 1, Type GD, handle lockable with 2 padlocks.

B. Enclosure: NEMA 4X stainless steel, unless specified or required otherwise to meet environmental conditions of installed location.

2.02 CIRCUIT BREAKERS

A. Molded Case Circuit Breakers: The current interrupting capacity of the breaker shall be equal or greater to 22,000 amps, unless otherwise indicated.

2.03 TRANSFORMERS

A. Dry Type Lighting Transformers:

1. Transformers shall be dry type, two-winding with KVA and voltage ratings as shown on the Drawings.

2. Four full capacity taps shall be furnished, two 2-1/2% above and two 2-1/2% below rated primary voltage.

3. Transformers shall be built in accordance with ANSI C89 and NEMA ST1-4 with a maximum insulation temperature rise of 115 degrees C.

4. Transformers shall be manufactured by the General Electric Co., or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install enclosed switches and circuit breakers in locations, as indicated, according to manufacturer's written instructions.

B. Install enclosed switches and circuit breakers level and plumb.

C. Install wiring between enclosed switches and circuit breakers and control/indication devices.

D. Connect enclosed switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts according to equipment manufacturer’s published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

END OF SECTION

SECTION 16482

480-VOLT MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test the motor control centers as hereinafter specified and as shown on the Drawings.

1.02 QUALIFICATIONS

A. The motor control centers shall be the product of a manufacturer who shall also be the manufacturer of all the circuit breakers, fused switches, variable frequency drives and motor starters included in the motor control centers.

B. All units and sections shall be U.L. labeled when possible. Motor control centers containing service entrance equipment shall be U.L. labeled "Suitable For Use As Service Equipment."

C. The motor control centers shall be manufactured by approved suppliers listed in Orange County Appendix “D”, which is provided in Appendix 3 of these technical specifications for reference.

1.03 SUBMITTALS

A. Complete master wiring diagrams and elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the motor control centers and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable.

B. Submittals shall include a bill-of-material listing conductor material and insulation type as well as other hardware and equipment to be furnished.

C. Where it is not explicitly shown and completely obvious from the outline drawings the following items shall be verified in a written statement accompanying the shop drawings.

1. Type of terminal blocks used and that the removal of plug-in compartments can be performed without disconnecting or removing wires.
2. Silver or tin plating of bus.
3. Insulation and isolation of vertical bus.
4. U.L. approval.

1.04 RELATED WORK

A. Lighting Panels are included in Section 16160.

B. Dry type lighting transformers are included in Section 16476.

C. Surge Protection Devices (SPD) are included in section 16709

PART 2 - PRODUCTS

2.01 RATING

A. The motor control centers shall be designed for 480 volt, 3 phase, 3 wire 60 Hz service and shall have short-circuit rating of not less than 65,000 amperes RMS, symmetrical.

2.02 CONSTRUCTION

A. Structure:

1. The motor control centers shall be a standard metal-enclosed, free-standing, deadfront structure, not more than 90-inches in height, and fabricated from formed sheet steel of not less than No. 14 gauge thickness. The enclosure shall be NEMA 1. The motor control centers shall consist of vertical sections of equal height and 20 inches deep containing individual plug-in compartments. Compartments shall be isolated from each other by separate horizontal steel plates or by steel plates without openings that are a part of the compartment itself.

2. Plug-in compartments shall totally isolate enclosed equipment. All unused openings to the adjacent vertical wiring space shall be plugged. All openings used for wiring shall have insulating grommets.

3. Vertical sections shall be mounted on steel channel sills continuous on four sides, or with steel channel sills on two sides and end cover plates. Each compartment shall be provided with a hinged door of pan construction on the front and a door opening of sufficient size to permit ready removal of any of the equipment in the compartment. Interlocks shall be provided to prevent opening the compartment door when the disconnect device in the compartment is in the closed position. An interlock bypass device shall be furnished. Means of locking the disconnect device in the "Off" position shall be provided. Disconnect device operating mechanism shall not be attached to the compartment door.

4. All sections shall have the same structural features with provisions for the addition of similar sections at either end. Each compartment shall meet NEMA Standards for the control equipment installed and units of similar size shall be interchangeable.

5. Each section shall be provided with a horizontal wiring space which shall line up with a similar space in the adjacent section or sections, with openings between so that wires may be pulled the entire length of the control centers. There shall also be provided in each section a vertical wiring space with separate full height door.

6. The motor control centers shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.

7. The motor control centers shall have engraved laminated nameplates screwed to the doors of each individual compartment and wiring diagrams pasted inside each door. Compartments containing panel boards shall have a card holder on the inside of the door. Compartments containing motor starters shall each have an overload heater selection table pasted inside the door.

8. The motor control centers shall provide equipment of type, capacity, trip ratings for the loads shown on the Drawings or otherwise specified.

9. Construction shall be NEMA Class II, Type B or C. In so far as possible all devices and components used shall be of one manufacturer. The motor control centers shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit.

10. The motor control centers shall be finished with ANSI Z55.1, No. 61 light gray enamel over a rust resistant primer.

11. The insulation level of the complete motor control assembly shall be such that it will meet the field tests required under Paragraph 3.02.

B. Buses:

1. All buses shall be silver on tin-plated copper. A continuous main horizontal bus shall be furnished. Main buses shall be rated as shown on the Drawings.

2. Each vertical section shall have a full height vertical bus rated not less than 300 amperes. Vertical buses shall be insulated and isolated with glass polyester or equivalent continuous insulation. Taped buses will not be acceptable. Unused stab openings shall be plugged. Lower ends of vertical buses shall be insulated.

3. A 1/1-inch x 2-inch ground bus shall be furnished the entire length of the motor control centers.

4. Buses shall be braced for 65,000 amperes RMS, symmetrical, short circuit current.

5. All buses except neutral and ground buses shall be completely isolated by steel plates or insulating material.

6. The buses shall be sized for a maximum current density of 400 amperes per square inch.

C. Wiring:

1. All wiring shall be copper.

2. Compartment wiring shall be to compartment mounted, plug-in terminal blocks that allow compartments to be withdrawn without having to remove wires from fixed terminal blocks.

3. Power wiring shall be black, control wiring shall be red, wiring energized from sources other than the starter control power transformer shall be yellow.

D. Signage:

1. Each motor control center shall be furnished with a sign marked "DANGER - HIGH VOLTAGE." Letters shall be not less than 1-inch high, 1/4-inch stroke. Signs shall be laminated plastic, engraved red letters with a white background.

2. All compartments with voltages from sources outside of the compartment, not disconnected by the motor circuit protector, shall have a sign on the compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM A SOURCE OUTSIDE OF THIS UNIT." Letters shall be black on a high visibility yellow background. Background shall be laminated plastic approximately 3 inches x 5 inches.

2.03 COMPONENTS

A. Incoming Feeder terminations and device:

1. Incoming cable shall terminate within the control center on a main breaker termination point. Main lug terminations shall have adequate dedicated space for the type and size of cable used and the lugs shall be compression-type with anti-turn feature. Main breaker shall be provided as indicated on the drawings and shall be molded case.

B. Combination Motor Starters:

1. All motor starters shall be a combination motor circuit protector and contactor, 3-pole, 60-Hz, 600-volt, magnetically operated, of the types shown on the drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings, but shall be not less than NEMA Size 1.

2. All motor starters shall have a 120-volt operating coil, overload relay in each phase and control power transformer.

3. All motor starters shall have 1-N.O. and 1-N.C. auxiliary contacts. Additional auxiliary contacts shall be furnished where shown on the Drawings or as required by the control scheme.

4. Full voltage, non-reversing starters, NEMA size 4 and smaller shall be of plug-in design with stab-on connectors engaging the vertical buses. Larger units shall be of fixed design.

5. Reduced-voltage starters shall be solid state type with closed circuit transition. Solid state transformers, six SCT full have type.

6. Overload relays shall be adjustable and manually reset by push button in compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.

7. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.

8. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits.

9. Variable Frequency Drives and Bypass- see VFD specification section 16370.

C. Circuit Breakers:

1. Circuit breakers shall be thermal-magnetic, molded case, 480 volt, with not less than 65,000 amperes, RMS interrupting capacity. All circuit breakers with 225 amperes frames and larger shall have interchangeable trips. Circuit breakers shall have auxiliary disconnect contacts when used with starters having external control circuits.

D. Control Stations:

1. Control stations shall be standard size, heavy-duty, oiltight.

E. Indicating Lights:

1. Indicating lights shall be standard size, heavy duty, oil tight, low voltage transformer operated.

F. Running Time Meters:

1. Running time meters shall be 3-1/2-inch square case; non-reset, 99,999.9 hour range; Type 236 as manufactured by the General Electric Co. or equal.

G. Metering:

1. Power Meter: The MCC shall be equipped with a digital-metering device

capable of communication on the network of choice. Meters shall be General Electric Co.'s. Type PQMII Power Quality Meter, or approved equal. The meter shall be able to communicate using Ethernet communications from power meters to SCADA. Through the use of communication user shall be able to read/write set-points, read actual values, execute commands and read device status loop-back test.

The meter shall provide continuous monitoring of all three phases. The meter shall measure current, voltage, real and reactive power, energy use, cost of power, power factor and frequency.

Power analysis features shall include an event recorder, waveform capture, trace memory, harmonic spectrum display (through the 62nd harmonic with total harmonic distortion) and a data logger function. The meter shall be able to sample harmonic spectrum at 256 samples per cycle. All analysis data shall be non-volatile. The meter shall automatically generate log for alarms, triggers and input/output events. 150 events records with time stamp shall be stored in the meter.

H. Instrument Transformers:

1. Instrument transformers shall be indoor, 600-volt, butyl-rubber molded, metering class designed in accordance with ANSI and NEMA standards.

I. Surge Protection:

1. As shown on the drawings.

J. Control Relays:

1. Control relays shall be heavy-duty, machine tool type with suitably rated convertible contacts. Time delay relays shall be pneumatic, adjustable.

2. Relays shall be CR2810 and CR2920 as manufactured by General Electric Co., or equal.

K. Nameplates:

1. Unit nameplates shall be black and white laminated plastic having engraved letters approximately 3/16-inch high extending through the black face into the white layer. Nameplates shall identify equipment controlled or circuit designation as applicable.

2.04 SPARE PARTS

A. The following spare parts shall be furnished:

1. One (1) box of power fuses of each size furnished.
2. One (1) set of starter contacts for each NEMA size installed.
3. One (1) starter coil for each NEMA size installed.

4. One (1) box of pilot lights.
5. One (1) breaker for each size used.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The motor control center housings shall be bolted to angle iron sills imbedded in the concrete on the two longest sides. The sills shall be the full length of the motor control center housing and shall be installed level in all directions.

B. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit terminations are not stressed.

C. The motor control centers shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angle.

D. The motor control centers shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by motor control centers manufacturer.

3.00 TESTS AND CHECKS

A. The following minimum tests and checks shall be made after the assembly of the motor control centers, but prior to the termination of any field wiring.

1. Megger terminals and buses after disconnecting devices sensitive to megger voltage.

2. A 1,000 VDC megger shall be used for these tests.

3. The first test shall be made with main circuit breaker closed and all remaining breakers open. A second test shall be made with all circuit breakers closed.

4. The test results shall be recorded and forwarded to the Engineer for his review. Minimum megger readings shall be 100 megohms in both tests.

B. The following shall be done before energizing the motor control centers.

1. Remove all current transformer shunts after completing the secondary circuit.

2. Install overload relay heaters based on actual motor nameplate current. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.

3. Check all mechanical interlocks for proper operation.

4. Vacuum clean all interior equipment.

3.03 WARRANTY

A. Manufacturer shall include a five (5) year warranty, parts and labor, from date of substantial completion.

3.04 TRAINING

A. Manufacturer shall provide two (2) days of training, 1-day of classroom training and 1-day of field training.

END OF SECTION

SECTION 16500

LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

. Furnish and install complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contractors, clocks and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

1.02 STANDARDS

A. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be Underwriters Laboratories labeled.

1.03 RELATED WORK

A. Panelboards shall be as specified under Section 16160.

B. Conduit shall be as specified under Section 16100.

C. Wire shall be as specified under Section 16120.

D. Transformers shall be specified under Section 16108.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Switches:

1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type. All switches shall conform to Federal Specification W-S-896-D.

2. Wall switches shall be of the following types and manufacturer or approved equal.

a. Single pole - Arrow-Hart No. 1991 or Leviton No. 1221-2.
b. Double pole - Arrow-Hart No. 1992 or Leviton No. 1222-2.
c. Three way - Arrow -Hart No. 1993 or Leviton No. 1223-2.
d. Four way - Arrow-Hart No. 1994 or Leviton No. 1224-2.
e. Single pole, key operated - Arrow-Hart No. 1991-L or Leviton No. 1221-2L.

f. Momentary contact, 2 circuit, center off - Arrow-Hart No. 1895 or Leviton No. 1256.
g. Weatherproof cover for Arrow-Hart 2900 series tap action switches - Arrow-Hart Catalog No. 2881-G.

B. Receptacles:

1. Wall receptacles shall be of the following types and manufacturer or approved equal.

a. Single, 20A, 125V, 1P, 3W; Arrow-Hart No. 5361 or Leviton No. 5361.
b. Duplex, 20A, 125V, 2P, 3W; Arrow-Hart No. 5362 or Leviton No. 5362.
c. Corrosion-resistant, duplex, 20A, 125V, 2P, 3W; Arrow-Hart No. 5739-CR or Leviton No. 5362CR and Crouse-Hinds WLRD-1 cover.
d. 60A, 480V, 3P, 2W; weatherproof receptacle shall be Crouse-Hinds Catalog No. ARE6324 with Crouse-Hinds Catalog No. APJ 6385 plug.
e. Ground fault interrupter, duplex, 20A, 125V, 3P, 2W; Arrow-Hart No. GF5362 or Leviton No. 6899.
f. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart Catalog No. S-26.
g. Clock hanger, 15A, 125V, 2P, 3W; Arrow-Hart No. 452 or Leviton No. 628.
h. Single, 20A, 250V, 2P, 3W; Arrow-Hart No. 5461 or Leviton No. 5461.
i. Single, 30A, 125V, 2P, 3W; Arrow-Hart No. 5716N; cap: Arrow-Hart No. 5717N or Leviton No. 5371.
j. Clothes dryer, 30A, 125/250V, 3P, 3W; Arrow-Hart No. 9344N. Cap: Arrow-Hart No. 9352AN or Leviton No. 5209 and No. 9382-P.

2. Receptacles (Weatherproof/NEMA 4 Areas/Outside)

a. General Requirements: Receptacles in wet locations shall be installed with a hinged outlet cover/enclosure clearly marked “Suitable for Wet Locations While In Use” and “UL Listed”. There must be a gasket between the enclosure and the mounting surface, and between the hinged cover and mounting plate/base to assure proper seal. Taymac; Specification Grade.

3. Special wiring devices shall be provided as noted of the drawings.
a. Tamper resistant duplex receptacle Leviton No. 5262-SG or approved equal.
b. Wall switch occupancy sensor Leviton No. 6775 or approve equal.
c. Scene select microprocessor dimmer Leviton No. 17765 or approved equal.
d. Surge protective duplex receptacle Leviton No. 5380 or approved equal.

C. Device Plates:

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

2. Plates for surface mounted device boxes shall be of the same material as the box.

D. Lighting Fixtures:

1. Lighting fixture types shall be as shown on the "Lighting Fixture Schedule" on the Drawings.

E. Lamps:

1. All Light fixture lamps shall be LED.

2. All lamps shall be of one manufacturer.

F. Flexible Fixture Hangers:

1. Flexible fixture hangers used in nonhazardous areas shall be Type ARB and flexible fixture supports used in hazardous areas shall be Type ECHF as manufactured by the Crouse-Hinds Company or approved equal.

2. Steel channel, roll formed into U-shape, shall be used to span between building steel for mounting of fixtures where required by fixture location or as indicated on the Drawings. Channel shall be as manufactured by Unistrut Corporation or approved equal.

G. Lighting Contactor:

1. Lighting contactor shall be of the electrically operated, mechanically held type in NEMA 1 enclosures of the number of poles as called for on the Drawings.

2. Contactors shall be rated for 30A-600 volt contacts and be similar and equal to Automatic Switch Company bulletin 1255-166 RC.

H. Lighting Control Time Switches:

1. Time switches for the control of lighting shall have astronomic dials, reserve power and be similar and equal to the following types:

a. Where time switch is indicated for SPST maintained control it shall be similar and equal to Tork Time Controls Catalog No. 7100ZL (120V).

b. Where time switch is indicated for DPST maintained control it shall be similar and equal to Tork Time Controls Catalog No. 7200ZL (120V).

I. Photocell:

1. Tork 2101-has ability to TCPC turn on/off time clock; turn on manually to\ check lights during day, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Flexible fixture hangers shall be used for all pendant mounted fixtures.

D. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

E. Receptacles in process areas and shops shall be mounted 36 inches above the floor unless otherwise noted on the Drawings.

F. Receptacles in office and other like areas shall be mounted 18 inches above the floor unless otherwise noted on the Drawings.

3.02 SPARE LAMPS

A. Spare lamps shall be provide for all fixture types supplied. Quantity shall be 15 percent of total used on project.

3.03 CLEANING UP

A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

SECTION 16601

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required and install a complete lightning protection system for the Pump Building. The system shall include grounding all fencing, handrail and platform structures.

2. Material requirements shall be as listed for Class I buildings.

3. The lighting, protection scheme shown on the plans is intended to show protected and minimum requirements.

B. 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.

1. American National Standards Inst., Inc. (ANSI)
C-135.30 Galvanized Ferrous Ground Rods.

2. National Fire Protection Association (NFPA)
70-1987 National Electrical Code (NEC)
78-1986 Lightning Protection Code.

3. Underwriters Laboratories, Inc. (UL)
UL-96 Lightning Protection Components
UL-96A Installation Requirements for Lightning Protection Systems
UL-467 Grounding and Bonding Equipment.

1.02 QUALITY ASSURANCE

A. Equipment Manufacturer: The material furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems.

B. Supervision: The system shall be installed under supervision of, or by, a person specifically trained for installation of lightning protection systems.

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted in accordance with Section 01340 and shall consist of a complete list of materials, including manufacturer's descriptive and technical literature; catalog cuts; drawings; and installation instructions. Shop drawings shall contain details to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

B. Proof of Compliance: Where materials or equipment are specified to comply with requirements of the UL, proof of such compliance shall be submitted. The label of or listing in the UL Electrical Construction Materials Directory will be acceptable evidence. In lieu of the label or listing, a written certification may be submitted from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters' Laboratories.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General Requirements:

1. The system furnished shall be complete with all air terminals, fittings, clamps, supports, roof conductors, down conductors, and horizontal grounds required. The system shall be interconnected with the building ground grid. All conductors, fittings, clamps, and air terminals furnished shall be of the highest quality.

2. System shall be an exposed conductor system. Care shall be taken that the materials used will not discolor roofs or walls. Down conductors shall be protected to 10 feet above grade and shall be located so that visual impact will be minimal.

3. No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or non-magnetic material.

B. Copper: Copper conductors shall not be less than #6 AWG for main conductor and #8 for secondary conductor. Below grade conductors shall be #4/0 bare copper.

C. Air Terminals: Air terminals shall be 3/8 inch diameter stainless steel and a minimum 24 inches in length. Air terminals over 24 inches shall be supported.

D. Ground Rods: Ground rods shall be 3/4 inch by 10 feet copper-clad steel, with the top of the rod, 12 inches below grade minimum and a minimum of 2 feet from building foundation and footings.

E. Clamp-Type Connectors: Clamp-type connectors shall be of copper, bronze, or stainless steel. Clamps shall be secured with at least two (2) bolts or cap screws.

F. Metal Bodies: Metal bodies of conductance shall be bonded to the system if not within the zone of protection on an air terminal. Metal bodies of inductance shall be bonded to the system at their closest point to the system if within 6 feet of the system at their closest point to the system if within 6 feet of the system main conductor or other bonded metal body. The main lightning conductor shall be bonded to the main potable service water pipe.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General Requirements: The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground without passing through any non-conducting parts of the structure. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

B. Air Terminals: Air terminal design and support shall be in accordance with NFPA 78. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints with of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inches for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 78, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that

may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practical. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom thereof where nonmetallic spires, steeples, or ventilators are present, air terminals shall be mounted thereon or to the side. In addition, where spires or steeples project more than 10 feet above the building, the conductor between the air terminal and metal roof shall be continued to the nearest down conductor and securely connected thereto.

C. Roof Conductors: Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inches. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 4 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

D. Down Conductors: Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two (2) down conductors located as widely separated as practicable, at diagonally opposite corners. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors " exceeding 16 feet in length, ending at air terminals. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected where necessary, to prevent mechanical injury to the conductor.

E. Interconnection of Metallic Parts: Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

F. Ground Connections: Ground connections comprising continuations of down conductors form the structure to the grounding electrode shall securely connect the

down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

G. Grounding Electrodes: A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 2 feet, nor more than 10 feet, from the structure. The complete installation shall have a total resistance to ground of not more than 10 ohms (if a counterpoise is not used). When two of any three ground rods, driven not less than 10 feet into the perimeter, give a combined value exceeding 50 ohms immediately after driving, a counterpoise shall be used. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 2 feet nor more than 10 feet from the nearest point of the structure. All connections between, ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors (or their equivalent in the form of metal strips or wires) are then buried in the trenches.

H. Interconnection of Metal Bodies: Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. All metal bodies of conductance having an area of 400 square inches or greater or a volume of 1000 cubic inches or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inches. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lighting protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

3.02 TESTING

A. System shall be installed so that tests of the grounds may be performed upon completion of the installation of the system and in the future.

B. As soon as practicable after award of contract, the Contractor shall submit for approval complete details of the system including a layout drawing so that the system furnished can be coordinated in the refurbishing of the building.

END OF SECTION

SECTION 16709

SURGE PROTECTION DEVICES (SPD)

PART 1 – GENERAL

1.01 DESCRIPTION

A. The specified unit shall provide effective high energy transient voltage surge suppression, surge current diversion and high frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main overcurrent device. The unit shall be connected in parallel with the facility's wiring system.

1.02 RELATED DOCUMENTS AND APPLICABLE STANDARDS

A. Systems shall be designed, manufactured, tested and installed in accordance with the following applicable documents and standards:

1. Underwriters Laboratories (UL1449 3rd Addition and UL 1283)
2. ANSI/IEEE (C62.41 and C62.45)
3. Military Standards (MIL – STD 220A)
4. National Electric Code (NEC)
5. Underwriter's Laboratories 248

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

Power Only Protection
For low voltage protection use: MTL, Phoenix, Edco Surge Protection

Current Technologies
Power & Systems Innovations
PO Box 590223
Orlando, FL 32859-0223

Contact:	John West Sr.
	Phone (407) 380-9200
Phone	(800) 260-2259
FAX	(407) 380-3911 FAX
E-mail	jwest@psihq.com
Internet	www.psihq.com

Joslyn, AKA (Total Protection Solutions)
Total Protection Solutions
4366 LB McLeod Road
Orlando, FL 32804

Contact:	Bob Levit
Phone	407-841-4405
FAX	407-841-4407
E-mail:	bob@treborpowersystems.com
Internet	www.treborpowersystems.com

Surge Suppression Inc
Surge Suppression Incorporated
P.O. Box 674
Destin, FL 32540-0674

Contact:	Mike Barton
Phone	(888) 987-8877
FAX	(888) 900-8879
E-mail	mbarton@surgesuppression.com

2.02 DEVICES

A. Surge Protection Devices (SPD's) shall be UL listed at or above the available fault current level at the point of SPD application by UL, Per UL 1449 latest edition.

B. The SPD shall be a parallel design using fast-acting energy protection that will divert and dissipate the surge energy.

C. Units shall have:

1. Minimum 10 mode operation for all 3 phase Y and high leg Delta configurations and six modes of protection for all 3 phase Delta "no Neutral" configurations.
2. One nanosecond or less response time for any individual component, and shall be self-restoring and fully automatic.
3. Extended noise filtration with a 10 kHz to 100 MHz range.
4. LED indication of unit failure to indicate the continuous positive operational status of each protected phase.
5. System Voltage shall be as indicated on the drawings.
6. The fusing system shall be capable of allowing the rated maximum single impulse surge current to pass through without fuse operation.
7. SPD's shall be installed with leads as shorts as possible (not to exceed 24 inches). SPD's may be mounted internally in Motor Control Centers, switchgear and switchboards. SPD's shall be mounted externally at panelboards and control panels.
8. All SPD panel units shall be guaranteed by the installing contractor and surge suppression manufacturer to be free of defects in materials and workmanship

for a period of not less than 10 years from the date of substantial completion of the system to which the suppressor is installed.

9. For each SPD type or size used on this project provide the following submittal data:

    a. Complete schematic data for suppressor, indicating part numbers, dimensional drawings and mounting arrangement.
    b. Cut sheets which include Peak Surge Current "per mode", Let Through Current, UL tested voltage protection rating (VPR) and maximum Continuous Operating Voltage (MCOV).
    c. Copy of Warranty Statement

2.03 APPLICATIONS

Surge Current RATING OF 150 kA PER MODE AT 480 Volt distribution panels.

Surge Current RATING OF 150 kA PER MODE AT 480 Volt Motor Control Centers.

Surge Current RATING OF 150 kA PER MODE AT 480 Volt branch panels or control panels.

Surge Current RATING OF 40 kA PER MODE AT 208 or 240 Volt three phase or single phase branch panels.

2.04 FILTERING

A. The system shall provide a UL 1283 Listed Electromagnetic Interference Filter capable of attenuating noise levels produced by electromagnetic interference and radio frequency interference.

2.05 FUSING

A. Fuse component(s) identification and surge rating. The manufacture shall provide documentation demonstrating the tested surge current rating (8x20µsec) of the fuse. The surge rating of the fuse shall be greater than the combined surge current rating of all downstream connected suppression elements.

B. Fusing: Suppression component(s) identification and surge rating. The manufacturer shall provide documentation identifying the suppression element(s) connected in series with fuse element(s) and provide the suppression elements published 8x20µsec surge current rating. The rating of the suppression element(s) shall be less than the rating of upstream fusing element(s).

C. Fusing: Surge performance. All fusing shall be required to meet the single pulse surge current testing requirements of Section 2.2 above.

D. Fusing: Isolation. The unit shall have each MOV fused and designed to operate only in the event of an MOV failure within the SPD device.

E. Fusing Coordination: Units that can't demonstrate MOV-fuse coordination in 2.4.a and 2.4.d are not acceptable.

F. Fusing: UL Rating. All fusing shall be 200kAIC UL248 Recognized.

2.06 UL 1449 SUPPRESSED VOLTAGE RATING.

A. The unit shall be UL 1449 3rd Edition Listed and shall be as follows for L-N, L-G, N-G, and L-L, modes, inclusive of the disconnect switch: (Select appropriate product rating from below)

1. 40kA – 80kA rated products/120/208V units: L-N = 400V, L-G=500, N-G=500, and L-L=700
2. 60kA – 80kA rated products/277/480V units: L-N = 900V, L-G=1000, N-G=90, and L-L=1800
3. 100kA – 150kA rated products/120/208V units: L-N = 400V, L-G=500, N-G=500, and L-L=700
4. 100kA – 150kA rated products/277/480V units: L-N = 900V, L-G=1000, N-G=800, and L-L=1500
5. 200kA – 300kA rated products/120/208V units: L-N = 400V, L-G=500, N-G=500, and L-L=700
6. 200kA – 300kA rated products/277/480V units: L-N = 800V, L-G=1000, N-G=800, and L-L=1500

2.07 IN-FIELD TESTING

A. The unit shall be equipped with a performance data extraction protocol allowing performance data, including percent of protection remaining, to be transmitted to an internal, external status analyzer.

2.08 ENCLOSURE.

A. Outside - Units shall be provided in a NEMA type 4X plastic enclosure.
B. Interior – Units shall be provided in NEMA type 1 enclosure.

PART 3 – EXECUTION

3.01 SYSTEM TESTING

A. Upon completion of installation, a factory-authorized local service representative shall provide product startup testing services. The tests shall include:

1. On-line Testing: Verification that all suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage.

2. Off-line Testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. To be compared to factory benchmark test parameters supplied with each individual unit.

3.02 DOCUMENTATION AND REPORTING

A. A copy of the startup test results and the factory benchmark testing results shall be supplied to the engineer and the County for confirmation of proper system function. This letter shall also clarify that the integrity of all neutral-to-ground bonds were verified through testing and visual inspection, and that all grounding bonds were observed to be in place.

3.03 SYSTEM WARRANTY

A. The TVSS system manufacturer shall warranty the entire system against defective materials and workmanship for a period of ten (10) years following substantial completion.

END OF SECTION

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SECTION 16725

CARD ACCESS SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section covers design, furnishing, and installation of a motorized entrance gate with a card access system which includes, but is not limited to, security control panels, power supplies, gate and gate operators, gate control panels, SCADA system interface, and proximity/keypad card controller and readers.

B. The motorized gate and card access system shall be compatible with County existing card access control systems. The System Supplier shall be responsible to provide all equipment specified herein, and shall subcontract the gate and gate control system to an County approved, certified installer. The System Supplier shall subcontract the card access control system to an County approved, certified installer.

C. The System Supplier and his subcontractors shall be responsible for the integration and configuration of the new Card Access Control System equipment with the SCADA equipment and Ethernet connectivity to the hub such that personnel the remote regional facilities shall be able to access and make changes that may be necessary to the Card Access Control System to control access to the International Drive Potable Water Booster Pump Station entrance gate.

D. All associated equipment, devices, cabling (fiber-optic and copper), system configuration, and controls necessary for proper operation shall be included.

1.02 GENERAL

A. The System Supplier shall furnish all installation drawings, tools, equipment, conduit, wiring, materials, and supplies and shall perform all labor to complete the work as specified, and in compliance with all applicable codes, standards, and regulations.

B. System Supplier shall coordinate with Contractor and any sub-contractors (including electrical) to provide all additional conduit and wiring required for a complete operable system beyond the use of conduit marked for security use as shown on drawings.

C. The card access system shall use Electronic Card Access System (ECAS) pass cards. As such, the new card access system shall be compatible with the recently installed systems at other County facilities by the System Supplier.

D. The System Supplier shall review the specifications and supply equipment that meets the functional requirements indicated, and shall furnish and install additional or differing components if required.

E. Suppliers Qualifications:

1. The design, equipment, installation, and installation supervision furnished under this section shall be provided by a manufacturer or supplier who has been engaged in the business of supplying these types of equipment for at least 5 years.

2. The card access system supplier shall be a Lenel Security Management System certified dealer/installer.

F. Governing Standards:

1. All wiring and components shall meet the applicable requirements of the National Electrical Code (NEC).

G. Nameplates:

1. Major components of equipment shall be identified with a permanently affixed nameplate bearing the manufacturer's name and address, and type or style and catalog number of the item.

H. Tags:

1. Keys and locks, where required, shall be furnished with tags bearing stamped identification number. Cable and conduit runs, wiring circuits, and all spare parts supplied to maintain the equipment shall be furnished with hard phenolic or stainless steel tags.

I. Power Requirements:

1. Primary power supply to all components will be 120 volts, 60 Hz, single phase. The System Supplier shall be responsible for meeting all additional power supply requirements and shall furnish any transformers or other power supply equipment needed.

1.03 SUBMITTALS

A. Complete wiring diagrams; assembly and installation drawings; detailed specifications; and data covering the materials used and the parts, devices, and other accessories forming a part of the equipment furnished shall be submitted in accordance with the submittals section. The equipment submittals shall include the following:

1. A complete description of all components, including certification of listing by UL.

2. Complete sequence of operation for all functions of the equipment.

3. Complete wiring diagram for all components and interfaces to equipment supplied under other sections or by the County.

4. Location drawings for all components.

5. A listing of the manufacturer's representatives responsible for installation and servicing.

6. Conduit and cabling to all equipment locations.

1.04 SECURITY SYSTEM DESCRIPTION

A. The system shall be furnished as a complete package consisting of a security panel, gate card reader control panel gate keypad and proximity card readers to monitor and control access to the International Drive Potable Water Booster Pump Station access gate. The system shall consist of one (1) security control and gate card access panel located in the Electrical Room, one (1) keypad, dual proximity card reader for the gate. Any additional equipment required to provide a functional system shall be provided by the System Supplier.

PART 2 - PRODUCTS

2.01 CARD ACCESS SYSTEM

A. Gate Card Access System:

1. The system shall be furnished as a complete package consisting of a dual card key pad/proximity readers, card access controller, system controller, control panel, and all wiring, configuration, and unspecified components necessary for a complete and functional system as described in the specifications and drawings.

B. Gate Card Access System Components:

1. Required components are listed below:

a. Security Panel. Lenel 2220 security control panel and controller. The controller shall have Ethernet capability. The enclosure shall be a Lenel LNL CTX or approved equal. The security control panel shall include power supplies, fiber optic transceivers, and fiber optic patch panels as required. Fiber optic transceivers shall be model IFS D1300. Power supplies shall be model AL300ULX. The controller shall be battery backed-up and shall be no less than 10 minutes. Panel shall be capable of supporting the number of inputs and outputs required for the card readers indicated on the drawings. The panel shall have ample room for wiring and circuit boards, be capable of storing up to 32,000 cards per site, retain last 6000 transactions, monitor forced entry and held open conditions, heavy duty 10 amp relays monitored by the plant control system, fiber optic patch panel, fiber optic transceiver, Lenel card reader(s) and Lenel Intelligent System Controller. The control panel shall operate from a 120 volt AC, 60 Hz power supply. Control panel shall be manufactured by Lenel, Inc. and no other. The System Supplier shall be responsible to connect and fully integrate the System Controller Panel to COUNTY existing card access system used at other COUNTY facilities.

b. Remote Card Reader Control Panel. Lenel 1320 card reader interface and control panel located at gate. Enclosure shall be NEMA TYPE 4X aluminum or 316 stainless steel, painted white. Panel shall provide interface for the gate proximity card reader. The panel shall have ample room for wiring and circuit boards, monitor forced entry and held open conditions, contain fiber optic patch panel, fiber optic transceiver and Lenel card reader.

c. Proximity Card Reader. Microprocessor based magnetic type card reader terminals shall be located as shown on the drawings, one mounted at automobile height shall be located at the entrance gate. Card Readers shall have an operating temperature of -22 to 150 degrees Fahrenheit, and shall have an operating humidity of 0-95% non-condensing. Card Readers shall have a typical read range of up to 9 inches. Card Readers shall read encoded data from access card and transmit the data back to the Card Reader Control Panel. Card Reader shall give an audible and visual indication of a properly read card. Card Readers shall be operated from a 10-28 volt DC power supply. Card Readers shall be furnished with transient voltage surge suppression devices. Card Readers for the operations building shall be the HID ProxPro 5355.

d. Gate Operator Pedestal. Double goose necked aluminum pedestal mount for high (truck) and low (automobile) mounted card readers.

e. HID ProxPro series 5355, 125 kHz, Wiegand protocol, proximity card readers with keypad option. The reader shall be sealed in an indoor/outdoor, polycarbonate enclosure suitable for harsh environments. Readers shall be vandal resistant, an operating temperature of -22 to 150 degrees Fahrenheit, and a read range of up to seven (7) inches. Card readers shall read encoded data from access card and transmit the date back to the card reader interface panel. The card readers shall give an audible and visual indication of a properly read card. The readers shall be furnished with transient voltage surge suppression devices.

2. Component Certifications:

a. Where required by NEC or local codes, all security equipment and materials, devices, and assemblies shall be listed and/or labeled by UL or another accepted testing laboratory for the intended purpose. The equipment shall not be installed, altered, or modified in any way that would void the label or listing.

b. All control equipment shall have transient voltage protection devices in compliance with UL 864.

3. Spare Parts and Special Tools:

a. Spare parts and special tools as recommended by the equipment supplier and as may be listed below shall be furnished. These will

include three sets of any disposable parts which would normally be changed during routine equipment maintenance and any special tools required for disassembly of the equipment.

b. The following minimum spare parts shall be supplied with the security equipment; one (1) each of each type of power supply and fiber optic transceiver, and spare batteries as recommended by the manufacturer. Provide one hundred (100) spare cards.

c. Spare parts shall be suitably packaged for shipment.

4. Warranty:

a. The System Suppliers warranty shall be one (1) year on all parts and labor.

C. Electric Motorized Gate:

1. The facility gate system shall be furnished as a complete package by the Contractor consisting of a vehicular motorized slide gate as shown on the drawings and as specified in Specification Section 02820 Fences and Gates. The gate system shall include the slide gate, automatic gate operator, and all required structural and safety equipment. Facility ingress shall be by the card access system above. Facility egress shall be by road imbedded proximity vehicle detector. The gate controller and gate operation shall be integrated with the card access control system and the SCADA system.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be installed in accordance with the manufacturer's diagrams and recommendations except where otherwise indicated.

B. After completion of the installation, the System Supplier shall clean the inside and the outside of the security equipment and shall remove any dirt and debris from the site.

C. Cable:

1. Cable shall be installed in accordance with Section 16120. The conductors shall be installed in conduits or junction boxes separate from conductors of other systems. Conduit fill shall meet applicable NEC requirements.

D. Raceways:

1. Conduit shall be installed in accordance with section 16100. Exposed conduit systems shall be rigid steel. Concealed conduit systems shall be PVC schedule 40.

3.02 FIELD QUALITY CONTROL, CHECKOUT AND TESTING

A. The Contractor shall perform field quality control, checkout, and testing, and shall submit required documentation in accordance with Section 01450 – QUALITY CONTROL, 01650 – Pump Station Startup Requirements, and any special field testing requirements as may be listed below or elsewhere in this section of these project specifications. Shop testing, if required, is addressed elsewhere in this section.

B. Prior to starting any on-site testing the Contractor shall submit a testing protocol to the PM in accordance with the requirements of Section 01650. The protocol shall address preparation, calibration, testing procedures, measurement, and documentation for the required Functional, Start-Up, and Demonstration tests.

3.03 OPERATION, MAINTENANCE AND INSTRUCTION MANUALS

A. Operation, Maintenance and Instruction Manuals for the equipment and systems identified in Section 16725 shall be furnished in accordance with Section 01300 – Submittals, and Section 01720 – Project Record Documents And Survey.

3.04 MANUFACTURERS' FIELD SERVICES AND TRAINING

A. Equipment manufacturers or suppliers shall provide the services of a factory-trained manufacturer's representative or agent and maintenance personnel as required to participate in installation, check-out, and testing of equipment and systems, and in the training of County plant operating personnel as required by Section 01650 – Pump Station Startup Requirements and this section. The representative shall have complete knowledge of proper installation, operation, and maintenance of the equipment and systems supplied.

B. The manufacturer's representative or agent shall visit the site or classroom designated by the County, for the minimum person-days listed below, travel time excluded.

1. Full time as required. The System Supplier shall provide on-site supervision of installation.

2. 3 days: Inspection, checking, and adjustment of equipment, including submittal of Manufacturer's Certificate of Proper Installation in accordance with 01650 – Pump Station Startup Requirements.

3. 2 days: Participate in Functional Tests, Start-Up Tests, and Demonstration Tests and in preparation of required certifications in accordance with 01650 – Pump Station Startup Requirements.

4. 2 days: Participation in Manufacturer's Training Services of County's Personnel.

END OF SECTION

APPENDIX 1

PERMITS

- **FDEP PERMIT TO CONSTRUCT PWS COMPONENTS**
- **10-2 CERTIFICATION**
- **FDOH HOLDING TANK PERMIT**

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APPENDIX 2

GEOTECHNICAL SOILS REPORT

- **GEOTECHNICAL ENGINEERING REPORT I-DRIVE POTABLE WATER BOOSTER PUMP STATION (APRIL 8, 2014)**
- **GROUNDWATER SAMPLING/TESTING I-DRIVE POTABLE WATER REPUMP FACILITY (NOVEMBER 7, 2013)**

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APPENDIX 3

LIST OF APPROVED PRODUCTS

APPENDIX D OF THE MANUAL OF STANDARDS AND SPECIFICATIONS FOR WATER, WASTEWATER AND RECLAIMED MAIN CONSTRUCTION

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APPENDIX 4

APPLICABLE FORMS FROM ORANGE COUNTY UTILITIES "STANDARDS AND CONSTRUCTION SPECIFICATION MANUAL APPENDIX B – FORMS"

- **DIGITAL DATA SUBMISSION**
- **PRESSURE TEST**
- **PUMP STATION START-UP**
- **RISK MANAGEMENT JUNE 02**
- **WATER MAIN DISINFECTION CERTIFICATION**

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