PROJECT MANUAL

FOR THE

WATER SUPPLY FACILITIES
CHEMICAL SYSTEM IMPROVEMENTS

TECHNICAL SPECIFICATIONS

Prepared For:

ORANGE COUNTY GOVERNMENT
FLORIDA

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BID SET

WATER SUPPLY FACILITIES
CHEMICAL SYSTEM IMPROVEMENTS
TECHNICAL SPECIFICATIONS

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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 office of the Engineering Division, Orange County Utilities Department, 9150 Curry Ford Road, Orlando, FL 32825.

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 that will ensure completion of the Work within the Contract Time stipulated.

B. All materials, equipment, skills, tools, and labor that are 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 City, County, State, Federal, and other codes that 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 or her 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 or her 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.

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 (Divisions. 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 or her expense, to a condition similar or equal to that existing before the damage was done, or s/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.

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

E. 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 re-sodded, or the area where sod has been removed shall be restored with new sod in the manner described in the applicable section.

F. 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.

G. 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.

H. 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.

C. 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 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 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 $50.00 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 LABOR

A. Supervision: The Contractor shall keep the Contract under his or her own control and it shall be his or her 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 to 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.

1.08 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 or her full responsibility under this Contract.
2. All work 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 and meet the requirements as outlined in the Orange County Utilities Standards and Construction Specifications Manual. 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.

1.09 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.

1.10 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 s/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 Resident Project Representative (RPR) 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 that 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 (5) 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 RPR sufficiently in advance of his or her 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 s/he will notify the Contractor that the inspection will be made at a point other than the point of manufacture; or s/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 or her 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	A. Pipe Work: Every 300 ft. at each lift of compaction B. 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
Asbestos	Environmental testing of materials	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.

1.11 TRAINING

A. Unless otherwise specified, a minimum of 2 days of training shall be provided for each piece of equipment supplied, including all electrical installation, instruments, and testing equipment. Contractor shall video and audio record as specified in Section 01650. The Contractor shall submit a C.A.R. (Construction Assistance Request) from seven days prior to

the beginning of training. Contractor shall submit training agenda, instructor names and resumes, and training handouts to be used. Training shall be based on O&M manuals supplied by the Contractor.

1.12 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 or her 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.

C. Security

1. Contractor shall be responsible for protection of the site, and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons. Contractor shall comply with Orange County's security requirements to protect the Water Supply Facility (WSF).

2. The County is implementing special security measures to protect the public water system and the Contractor shall provide the same level of security. The Contractor shall provide the following security measures:

   a. Contractor will supply list of all personnel that will be on WSF site each morning to the County's RPR

b. All personnel, employees and or subcontractors and suppliers that pass through the security perimeter shall wear Contractor provided issued photo identification badges.

c. Contractor will supply list with names, driver license, and license plate numbers of all personnel.

d. All Contractor's and subcontractor's personnel passing through the security perimeter shall have background checks to identify any historical crimes dealing with terrorism, sabotage, or other government related illegal activities at the cost of the Contractor and before entering Orange County Utilities WRF. Proof of background checks shall be submitted to the County.

e. All project deliveries shall be inspected prior to entering the security perimeter of the Facility in order to verify contents. All delivery personnel and delivery vehicles shall be under supervision while within the security perimeter of the Facility in lieu of issuance of photo identification badges. The Contractor shall maintain staff to accept all deliveries to the site, the County will not be responsible for receipt of any deliveries.

f. If access other than the main gate is utilized, a full time guard shall be provided at the construction gate during Contractor working hours at the cost of the Contractor. All arrangements for alternative access shall be pre-arranged with the County. All alternative access must be secured and locked when not in use.

3. No claim shall be made against County by reason of any act of an employee or trespasser, and Contractor shall make good all damage to County's property resulting from Contractor's failure to provide security measures as specified.

D. Smoking Policy- Tobacco Free Campus

1. In order to protect the public health, safety, and welfare of citizens and employees, smoking tobacco or any other substance is prohibited in County owned or operated facilities and vehicles. Contractor's personnel will not be permitted to use tobacco products on County property, including County parking lots, break areas, and worksites. Smoking means the lighting of any cigarette, cigar or pipe, or the possession of any lighted cigarette, cigar, or pipe, regardless of its composition. This requirement shall be enforced from the beginning of construction and violators will be removed

1.13 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 or her own expense, provide suitable and

safe bridges and other crossings for accommodating travel by pedestrians and workers. 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. 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. At the end of each workweek, the S-I asphaltic surface course shall be completed and opened to traffic. Contractor shall coordinate 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 (but no sooner than 30-days after applying the S-I asphaltic surface), final restoration shall be performed. In no event shall final restoration begin after substantial completion. Final restoration shall provide an 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 businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business accesses with the business owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading 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. It is the Contractor's responsibility to verify all depths of marked locates as well as underground structures.

2. 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 the Contractor 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 that 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 or her expense as directed by the County. Any existing facilities that 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 that 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 be 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 (2) 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 five (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 1,000-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, s/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.

1.14 RELATED CONSTRUCTION REQUIREMENTS

A. Traffic Maintenance:

1. Maintain public highway traffic within the limits of the Project for the duration of the construction period, including any temporary suspensions of Work. Work shall also include construction and maintenance of any necessary detour facilities; furnishing, installing, and maintaining of traffic control and safety devices during construction, control of dust, or any other special requirements for safe and expeditious movement of vehicular and pedestrian traffic.

2. Traffic Control shall be provided at the Contractor's expense by the Contractor's personnel or off-duty uniformed police officer, depending on and as required by the applicable traffic control requirements jurisdictional to the construction or road.

3. The Contractor shall prepare and submit a Maintenance of Traffic plan (MOT) to the County/Professional and to the County Public Works Department for review and acceptance prior to commencing any Work on the site. The Traffic Control Plan shall detail procedures and protective measures proposed by the Contractor to provide for protection and control of traffic affected by the Work consistent with the following applicable standards:

   a. Standard Specifications for Road and Bridge Construction, Latest Edition including all subsequent supplements issued by the Florida Department of Transportation, (FDOT Spec.).

   b. Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations, FDOT.

   c. Right-of-Way Utilization Regulations, Orange County, Florida, latest edition. All references to the respective agency in the above referenced standards shall be construed to also include the County for this Work.

   d. The cost of any required road permits shall be borne by the Contractor.

   e. The Contractor will notify the public one (1) week in advance of any scheduled work via the use of portable message boards. The message boards shall be located at each approach to the construction area.

4. Before closing any thoroughfare, the Contractor shall give written notice to, and if necessary, obtain a permit or permits from the duly constituted public authority having jurisdiction over the thoroughfare. Notice shall be given no less than 72-hours in advance of the time when it may be necessary in the process of construction to close such thoroughfare, or as may be otherwise provided in the acceptable Maintenance of Traffic plan (MOT).

5. The Contractor shall sequence and plan construction operations and shall generally conduct his or her work in such a manner as not to unduly or unnecessarily restrict or impede existing normal traffic through the streets of the local community.

6. Insofar as it is practicable, excavated material and spoil banks shall not be located in such a manner as to obstruct traffic. The traveled way of all streets, roads and alleys shall be kept clear and unobstructed insofar as is possible and shall not be used for the storage of construction materials, equipment, supplies, or excavated earth, except when and where necessary.

7. If required by duly constituted public authority, the Contractor shall, at his or her own expense, construct bridges or other temporary crossing structures over trenches so as not to unduly restrict traffic. Such structures shall be of adequate strength and proper construction and shall be maintained by the Contractor in such a manner as not to

constitute an undue traffic hazard. Private driveways shall not be closed except when and where necessary, and then only upon due advance notice to the County and for the shortest practicable period of time consistent with efficient and expeditious construction. The Contractor shall be liable for any damages to persons or property resulting from his or her work.

8. The Contractor shall make provisions at all "open cut" street crossings to allow a minimum of one lane to be open for vehicular traffic at all times. Lane closing shall be as permitted by the local governing authority and shall be repaired to a smooth, safe driving surface immediately following the installation of pipe or conduit. Flaggers shall be required, in addition to barricades, signs and other protective devices at all lane closings.

9. The Contractor shall make provisions at cross streets for the free passage of vehicles and pedestrians, either by bridging or otherwise, and shall not obstruct the sidewalks, gutters, or streets, nor prevent in any manner the flow of water in the latter, but shall use all proper and necessary means to permit the free passage of surface water along the gutters.

10. The Contractor shall immediately cart away all offensive matter; exercising such precaution as may be directed by the County. All material excavated shall be so disposed of as to inconvenience the public and adjacent tenants as little as possible and to prevent injury to trees, sidewalks, fences and adjacent property of all kinds.

B. Barrier And Lights:

1. The Contractor shall exercise extreme care in the conduct of the Work to protect health and safety of the workers 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 10-feet of the roadway shall have flashing strobe lights attached.

C. Dewatering and Flotation:

1. The Contractor, with his or her 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, wetwells 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) that 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.

2. Contractor shall be responsible for any required permits for the discharge of ground water.

D. 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 that 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.

E. 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 or her 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-foot intervals using surveyors' level instrument.

F. Cutting and Patching:

1. The Contractor shall do all cutting, fitting, or patching of his or her 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 that 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.

G. 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 or her 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.

H. Daily Reports:

1. 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 labor, 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 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.

I. 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 that will not create hazards to health or property and that 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 s/he shall remove and promptly dispose of all water, dirt, rubbish, or any other foreign substances. Employ skilled workers 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.

1.15 CONSTRUCTION NOT PERMITTED

A. Use Of Explosives:

1. 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 or her 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 watchers. All permits required for the use of explosives shall be obtained by the Contractor at his or her expense. All requirements of the governmental agency issuing permit shall be observed.

PART 2 - PRODUCTS (NOT USED)

PART 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. This Contract is for the improvements at the following Orange County Utilities Department's Water Supply Facilities (WSF) as shown on the Drawings and specified herein: Cypress Walk, Orangewood, Hunters Creek, and Oak Meadows. The Work consists of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but not limited to, the expansion of or improvements to the equipment and structures associated with the following:

1. New sodium hypochlorite bulk storage tanks and metering pump skids in existing chlorine buildings/rooms.
2. New hydrofluorosilicic acid bulk storage tank, day tank and scale, and metering pump skid in existing fluoride buildings/rooms.
3. Demolition of the existing chemical systems at all WSFs and the caustic buildings at the Oak Meadows and Cypress Walk WSFs.
4. Temporary facilities as required to maintain the WSFs in service.
5. Relocation of existing facilities as shown and specified.
6. Site work and yard piping.
7. Mechanical, structural, electrical, controls and HVAC modifications and improvements associated with the new chemical systems.

1.02 CONTRACTOR'S USE OF PREMISES/SECURITY

A. The Contractor shall assume full responsibility for the protection and safekeeping of products and materials at the job site. If additional storage or work areas are required, they shall be obtained by the Contractor at no additional cost to the Owner.

B. The Contractor shall comply with the Owner's security and access guidelines at all times. Refer the Security and Access Guidelines in Attachment E to these Specifications.

1.03 SEQUENCE OF WORK

A. Contractor shall establish his or her work sequence based on the use of crews to facilitate completion of construction and testing within the specified Contract Time.

B. Contractor shall submit a detailed Sequence of Construction Plan indicating equipment and material deliveries, installation and testing of proposed temporary facilities, demolition, proposed periods of shutdowns, and demonstrating that the Water Supply Facilities remain online.

C. The sequence of demolition and renovation of existing facilities will be in accordance with the approved Sequence of Construction Plan. All shutdowns and connections shall be coordinated with and approved by the Owner with minimum 7 day notification of need

and coordination of date and time. Below is a basic outline of project sequence to be used as the basis for Contractor's detailed Sequence of Construction Plan for each WSF:

1. The Work shall be phased so that the improvements are under construction at only one facility at a time. Oak Meadows must be completed first.
2. The WSFs must remain in continuous, permit compliant operation at all times. Disinfection facilities shall be online at all times. Fully automatic temporary disinfection facilities shall be provided and tested by the Contractor prior to shut down of the existing sodium hypochlorite system. Temporary facilities must be tested and operate for 72 continuous hours prior to removal of the existing systems with notification to DEP with our without a permit.
    a. Temporary disinfection facilities shall provide the same level of treatment as the existing facilities. The temporary sodium hypochlorite feed pumps shall have a minimum capacity equal to the existing pumps at each WSF. The following is a list of existing sodium hypochlorite feed systems at each WSF.

Item	Pre and Post Chlorination
Liquid Pumped	12% Sodium Hypochlorite
Number of Pre-Chlorination Pumps	2
Number of Post-Chlorination Pumps	2
Pump Manufacturer/Type	Prominent / Mechanically Actuated
Pump Capacity	
Cypress Walk	34.3 gph
Orangewood	96.5 gph
Hunters Creek	34.3 gph
Oak Meadows	69.7 gph
Maximum Pressure	100 psig
Minimum Suction Lift	8 ft
Stroke Length Control	Manual
Stroke Speed Control	Manual and Remote signal 4-20 mA

    b. Temporary disinfection facilities shall be fully automatic and connected to the existing PLC for monitoring and control.
    c. Provide cover for all temporary disinfection equipment.
3. The WSFs shall not be taken offline for more than four (4) hours for tie-ins or switchovers.
4. Removal of the existing fluoride systems shall be scheduled to minimize the downtime of the fluoride addition.
5. The new facilities must be installed and cleared for service by FDEP before startup and testing of the new facilities. Clearance by FDEP shall be as required according to specific FDEP permit conditions and the requirements for disinfection and testing in accordance with 62-550 and 62-555 FAC.

1.04 PUBLIC UTILITY INSTALLATIONS AND STRUCTURES

A. The Contractor shall give written notice to all governmental utility departments and other owners of public utilities of the location of the proposed construction operations, at least seventy-two hours in advance of breaking ground in any area or on any unit of the Work.

B. Some of the utility contacts are listed on the plans for the Contractor's convenience.

C. The maintenance, repair, removal, relocation, or rebuilding of the public utility installation and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the utility involved.

1.05 CONTRUCTION TRAILERS, STORAGE AND PARKING

A. Provide construction trailers and other temporary facilities in accordance with the general requirements and Section 01580.

B. Construction trailers and primary storage areas shall be located at the Oak Meadows WSF for the duration of the project. The available temporary storage areas and parking is restricted at the remaining sites. Submit a storage and parking plan for each site to the Owner for review and approval. Any additional areas required for the Work shall be obtained by the Contractor at no cost to the owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 GENERAL

A. The Contractor shall receive and accept the compensation provided in the Proposal and the Contract as full payment for furnishing all materials, labor, tools, and equipment, for performing all operations necessary to complete the work under the Contract, and also in full payment for all loss or damages arising from the nature of the work, or from any discrepancy between the actual quantities of work and quantities herein estimated by the Engineer, or from the action of the elements or from any unforeseen difficulties that may be encountered during the prosecution of the work until the final acceptance by the Owner.

B. The prices stated in the proposal include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the Drawings and specified herein. The basis of payment for an item at the unit price shown in the proposal shall be in accordance with the description of that item in this Section.

C. The Contractor's attention is again called to the fact that the quotations for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor feel that the cost for any item of work has not been established by the Bid Form or Payment Items, s/he shall include the cost for that work in some other applicable bid item, so that his or her proposal for the project does reflect the total price for completing the work in its entirety.

1.02 MEASUREMENT

A. The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service, and accepted by the Owner, in accordance with the applicable method of measurement therefore contained herein.

1.03 PAYMENT ITEMS

A. Items are as enumerated on the bid form.
   1. Item 1 – General Requirements:
      a. Measurement for various items covered under General Requirements, Mobilization and Demobilization will not be made for payment and all items shall be included in the lump sum price.

b. Payment for General Requirements shall include all Insurance requirement costs, the cost of bonds, and all Administrative costs. This item will be paid upon each payment request made by the Contractor. The Contractor shall attach with the pay request invoices to substantiate that appropriate insurance and bonds have been obtained by the Contractor.
c. Payment for Mobilization/Demobilization will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for the preparatory work and operations in mobilizing for beginning Work on the project including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, and for the establishment of field office, building, safety equipment, and first aid supplies, sanitary and other facilities, as required by these Specifications and State and local laws and regulations; and any other preconstruction expense necessary for the start of the Work; the cost of field engineering, permits, and fees, construction schedules, shop drawings, temporary facilities, laydown storage area, construction aids, erosion control, work associated with contractor support during Owner/ Engineer reviews and inspection, re-inspections and any re-work resulting from same, as described in Section 01700: Project Closeout; and Section 01720: Project Records Documents. The Contractor shall submit invoices substantiating the cost of mobilization with each pay request. Mobilization/demobilization shall not be more than five percent (5%) of the Total Base Bid price. Ten percent of the cost for mobilization will be withheld until substantial completion and site clean-up.

2. Item 2 – Indemnification:
   a. Payment for Indemnification: In consideration of the Contractor's Indemnity Agreement as set out in the Contract Documents, Owner specifically agrees to give the Contractor $100.00 and other good and valuable consideration, receipt of which is acknowledged upon signing of the Agreement.

3. Item 3 – Construction of the Cypress Walk Water Supply Facility Hypochlorite System Improvements:
   a. Payment for the Cypress Walk Water Supply Facility Hypochlorite System Improvements will be made at the lump sum price based upon the approved schedule of values and progress payments.
   b. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Cypress Walk Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical, instrumentation, and electrical improvements required to complete the work as specified.

4. Item 4 – Construction of the Cypress Walk Water Supply Facility Fluoride System Improvements:
   a. Payment for the Cypress Walk Water Supply Facility Fluoride System Improvements will be made at the lump sum price, based upon the approved schedule of values and progress payments.

b. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Cypress Walk Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical, instrumentation, and electrical improvements required to complete the work as specified.

5. Item 5 – Construction of the Orangewood Water Supply Facility Hypochlorite System Improvements:
   c. Payment for the Orangewood Water Supply Facility Hypochlorite System Improvements will be made at the lump sum price, based upon the approved schedule of values and progress payments.
   d. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Orangewood Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical, instrumentation, and electrical improvements required to complete the work as specified.

6. Item 6 – Construction of the Orangewood Water Supply Facility Fluoride System Improvements:
   c. Payment for the Orangewood Water Supply Facility Fluoride System Improvements will be made at the lump sum price, based upon the approved schedule of values and progress payments.
   d. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Orangewood Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical, instrumentation, and electrical improvements required to complete the work as specified.

7. Item 7 – Construction of the Hunters Creek Water Supply Facility Hypochlorite System Improvements:
   e. Payment for the Hunters Creek Water Supply Facility Hypochlorite System Improvements will be made at the lump sum price, based upon the approved schedule of values and progress payments.
   f. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Hunters Creek Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical, instrumentation, and electrical improvements required to complete the work as specified.

8. Item 8 – Construction of the Hunters Creek Water Supply Facility Fluoride System Improvements:
   e. Payment for the Hunters Creek Water Supply Facility Fluoride System Improvements will be made at the lump sum price, based upon the approved schedule of values and progress payments.
   f. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Hunters Creek Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical,

instrumentation, and electrical improvements required to complete the work as specified.

9. Item 9 – Construction of the Oak Meadows Water Supply Facility Hypochlorite System Improvements:
   g. Payment for the Oak Meadows Water Supply Facility Hypochlorite System Improvements will be made at the lump sum price, based upon the approved schedule of values and progress payments.
   h. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Oak Meadows Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical, instrumentation, and electrical improvements required to complete the work as specified.

10. Item 10 – Construction of the Oak Meadows Water Supply Facility Fluoride System Improvements:
    g. Payment for the Oak Meadows Water Supply Facility Fluoride System Improvements will be made at the lump sum price, based upon the approved schedule of values and progress payments.
    h. These items shall include all materials, equipment, testing, permits, appurtenances, and work required for the Oak Meadows Water Supply Facility Improvements, including all demolition, structural, HVAC, mechanical, instrumentation, and electrical improvements required to complete the work as specified.

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, Gravity Main, 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, Gravity Main, 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 that 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 seven (7) executed copies of each Application for Payment to the County by means ensuring receipt within 24-hours. One (1) 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 (one (1) paper copy and electronic copy)
   3. Table 01050-2 Asset Attribute Data Form Examples (one (1) paper copy and electronic copy)
   4. Table 01050-3 Pipe Deflection Table Example (one (1) paper copy and electronic copy)
   5. Table 01050-4 Gravity Main Table (one (1) paper copy and electronic copy)
   6. An electronic copy of all survey field notes
   7. Partial consent of surety
   8. Site photographs
   9. Updated Progress Schedule: submit one (1) electronic copy and five (5) copies
   10. Summary of Values
   11. Pay Request
   12. On-Site Storage
   13. Draw schedule
   14. Responsibility and liability for material and equipment form

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 those 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 (1) 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 Services
   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. The Surveyor will identify control points (monuments and benchmarks noted on the Drawings). The construction layout survey shall be established from the control points shown on the Construction Drawings and confirmed. The method of field staking for the construction of the Work shall be at the option of Contractor. The accuracy of any method of staking shall be the responsibility of Surveyor. All staking shall be done to provide for easy verification of the Work by the County. The Contractor shall provide all surveys necessary for the construction of the Work.

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.

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 s/he has the hardware, software, and adequate scope of services in his or her 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 for the Work 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 for the Work.
   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- 2, 3, and 4.

PART 2 - PRODUCTS

2.01 SURVEY DOCUMENTS

A. Survey documents shall comply with the Minimum Technical Standards of Chapter 5J-17 of the Florida Administrative Code (FAC) and Table 01050-1 Minimum Survey Accuracies, whichever are more stringent. All coordinates shall be geographically registered in the Florida State Plan Coordinate System using the contract Drawings control points for horizontal and vertical controls.

B. The Surveyor shall not copyright any of their Work related to this project.

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-feet maximum 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	10-foot 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	Wetwell 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, stormwater, 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 | Pipe

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 Manufact	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
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

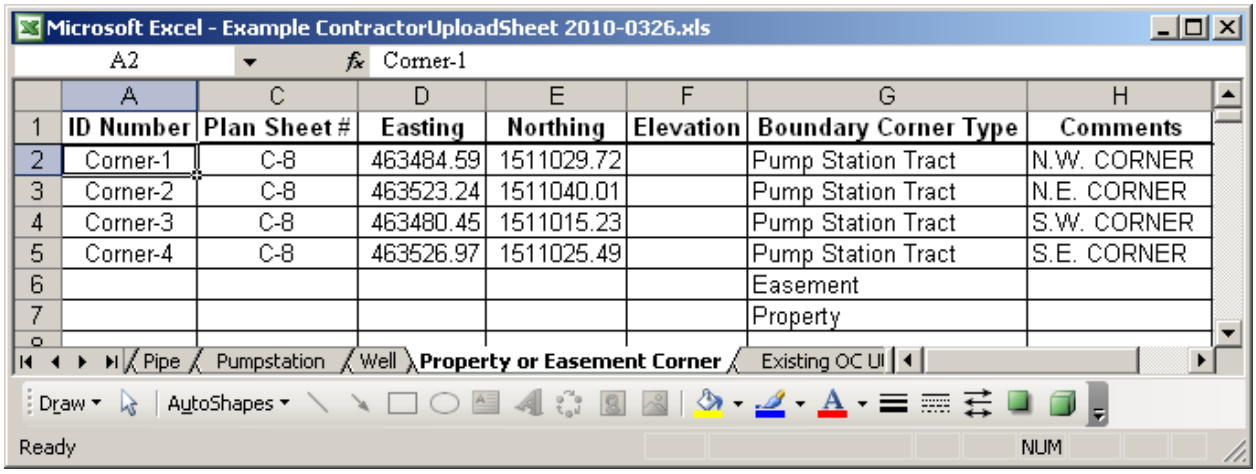
Well Worksheet

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

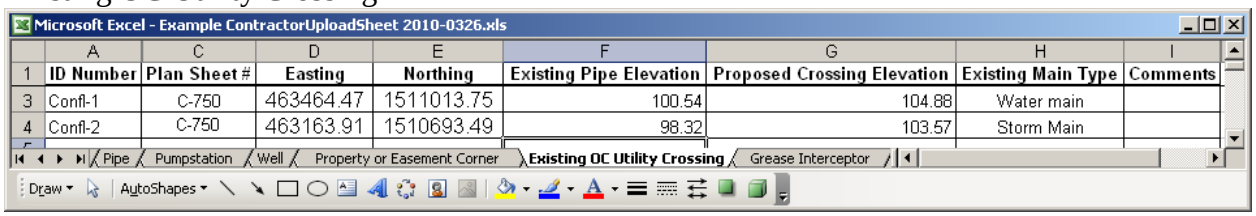
	A	C	D	E	F	G	H
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Boundary Corner Type	Comments
2	Corner-1	C-8	463484.59	1511029.72		Pump Station Tract	N.W. CORNER
3	Corner-2	C-8	463523.24	1511040.01		Pump Station Tract	N.E. CORNER
4	Corner-3	C-8	463480.45	1511015.23		Pump Station Tract	S.W. CORNER
5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

Draw | AutoShapes

Ready NUM

Existing OC Utility Crossing



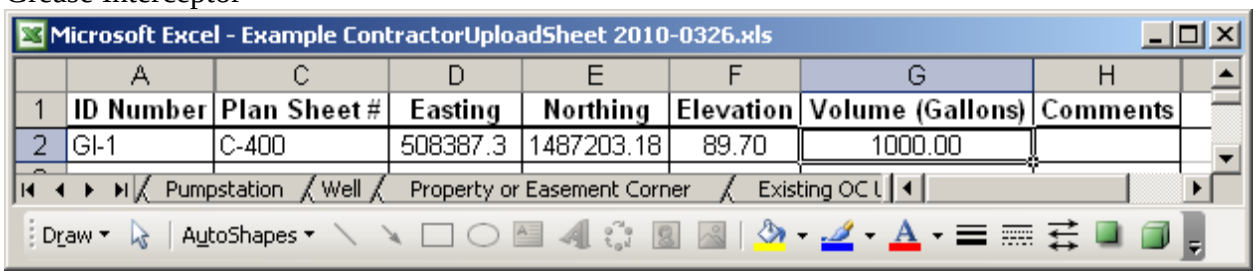
Microsoft Excel - Example ContractorUploadSheet 2010-0326.xls

	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	

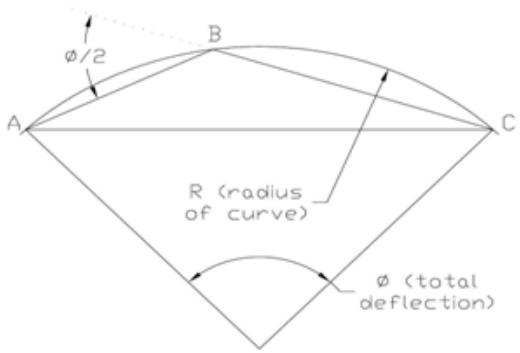
Pumpstation | Well | Property or Easement Corner | Existing OC l

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.

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 5J-17. 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.

3.03 SURVEY DOCUMENTS

A. The Tables 01050-2 Asset Attribute Data, 01050-3 Pipe Deflection Table, and 01050-4 Gravity Main Table shall be signed, sealed and dated by the Surveyor with each pay request as specified in Section 01027 "Application for Payment" and the requirements of Section 01720 "Project Record Documents."

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. Provide copies of all applications and supporting documents; and permits received by the Contractor for the Project.
4. 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.
5. A copy of the permits obtained by the County are furnished in Appendix C "Permits Obtained by County" of these specifications.
    a. FDEP Application for a Specific Permit to Construct PWS Components; DEP Form 62-555.900(1) for each Water Supply Facility.
6. 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.
7. Unless otherwise specified, the cost of work specified in this section, 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 (Orange County):

1. The County will pay the general building permit fee and any related impact fees or assessments to be paid to Orange County for the issuance of that permit only.
2. The Contractor shall pay all fees associated with obtaining Orange County trade permits and any and all inspection fees for the Orange County Building Department providing inspections for this project. The Contractor shall apply for and obtain the building permits from Orange County and schedule and obtain final approval from the building inspectors.
3. Information on Orange County Building Department fees is included in the Instructions to Bidders in Division 0.
4. 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.

C. Fire Protection System Permit (Orange County):

1. The Contractor shall apply and pay for all fees associated with obtaining Orange County Fire Rescue Department fire protection system permits.
2. The Contractor shall provide all materials and equipment to comply with the permit requirements at no additional cost to the County.
3. The Contractor shall pay any and all inspection fees for the Orange County Fire Rescue Department providing inspections for this project. The Contractor shall apply for and obtain the fire protection system permits from Orange County Fire Rescue Department and schedule and obtain final approval from the Orange County Fire Rescue Department inspectors.
4. Information on Orange County Fire Rescue Department permitting applications and fees can be found at http://ocfl.net/PermitsLicenses
5. The Contractor shall be responsible for scheduling all permit inspections and obtaining inspection approval from Orange County Fire Rescue, as required.

D. Construction Dewatering Permit: The Contractor shall apply and pay for all fees associated with obtaining Florida Department of Environmental Protection 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.

E. Stormwater Permit: The Contractor shall apply and pay for all fees associated with obtaining construction stormwater management including but not limited to FDEP Generic Permit for Stormwater Discharge from Large and Small Construction Activities, if required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01070

ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. 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 –
FDOT	Florida Department of Transportation
FAC	Florida Administrative Code
FS	Federal Standard
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NACE	National Association of Corrosion Engineers
NASSCO	National Association of Sewer Service Companies
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electrical Code
NECA	National Electrical Contractor's 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)

B. Units Of Measurement:

CU FT	cubic feet
CU IN	cubic inch(es)
CY	cubic yard(s)
DegC	degree(s) Centigrade
DegF	degree(s) Fahrenheit
F	Fahrenheit
FT	feet, foot
G	gram(s)
GA	gage
GAL	gallon(s)
GPH	gallon(s) per hour
GPM	gallon(s) per minute

GPS	gallon(s) per second
HR	hour(s)
IN	inch(es)
IPS	iron pipe size
KG	kilogram(s)
L	liter(s)
LB	pound(s)
LBF-IN	pound (force) inch
LF	linear foot, linear feet
MIN. min.	minute(s), minimum
ml	milliliter
MO	month(s)
OZ	ounce(s)
QT	quart
RH	relative humidity
SF	square foot, square feet
SQ IN	square inch(es)
YD	yard(s)
YR	year(s)

C. Terminology:

@	at
AB	anchor bolt
ADJ	adjust, adjustable
ADMIN	administration
AFG	above finished grade
AGGR	aggregate
AL	aluminum
ALT	alternate
APPX	appendix
APX	approximate
ART	article
ASPH	asphalt
ASSY	assembly
AUTO	automatic
AUX	auxiliary
AVE	avenue
AVG	average
AWG	American Wire Gauge
BAR	barrier
BCCMP	bituminous coated corrugated metal pipe
BL	base line
BLDG	building
BLKG	blocking
BM	beam

C to C	center to center
CCB	concrete block, masonry
CEM	cement
CIP	cast iron pipe, cast in place
CJ	construction joint
CL	center line, clearance
CM	Construction Manager
CMP	corrugated metal pipe
CO	cleanout
CONC	concrete
CONN	connection
CONST	construction
CONT	continuous
CONTR	contractor
CU, COP	copper
ORR	corridor
CRIT	critical
CTD	coated
CTR	center
CULV	culvert
d	delta
DBL	double
DEM	demolition, demolish
DEPT	department
DET	detail
DIA, D	diameter
DIAG	diagonal
DIM	dimension
DWG	drawing
FEM	female
FUT	future
FV	field verify
FM	force main
FH, HYD	fire hydrant
ID	inside diameter
MAS	masonry
MATL	material
MAX	maximum
MFD	manufactured
MFG	manufacturing
MFR	manufacturer
MH	manhole, metal hallide
MIN	minimum
MISC	miscellaneous
MTL	material

NAT	natural
NATL	national
NOM	nominal
NTS	not to scale
OD	outside diameter
PP	power pole
R	radius
Rd	road
REIN	reinforce
REL A	relief air
REQD	required
REV	revision
RPR	Resident Project Representative
RR	railroad
R/W	right-of-way
RWM	reclaimed water main
RY	railway
SAN	sanitary
SCH	schedule
SECT	section
SLV	sleeve
SQ	square
SST	stainless steel
ST	street
STA	station
STD	standard
SURF	surface
SUSP	suspend(ed)
SYM	Symbol, symmetrical
SYS	system
TEMP	Temperature, temporary
TYP	typical
UTIL	utility
W	West
WLD	welded
WM	water main
W/O	without
WT	weight
YD	yard
YR	year
Y W	wye

END OF SECTION

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SECTION 01091

REFERENCE SPECIFICATIONS

PART 1 - GENERAL

1.01 GENERAL

A. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies that have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of or omission from said standards or requirements.

B. Assignment of Specialists: In certain instances, specification test requires (or implies) that specific work is to be assigned to specialist or expert entities who must be engaged for the performance of the Work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work. They are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the Contractor.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of such referenced documents that are not in conflict with the requirements of these Specifications or applicable codes.

B. References herein to "Building Code" shall mean the Florida Building Code. The latest edition of the code shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, Drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or labor. The Contractor shall bid the most stringent requirements.

D. Applicable Standard Specifications: The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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 and Engineer will administer a pre-construction conference, periodic progress meetings and specific topic meetings throughout the progress of the Work. The County and Engineer will:
   1. County will distribute a notification of the meeting to required attendees.
   2. Engineer will establish, prepare and County will distribute an agenda with the notification.
   3. County will make physical arrangements for the meetings.
   4. Engineer will preside at meetings.
   5. Engineer will 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.

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

C. 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. Engineer
   3. Contractor and superintendent
   4. Subcontractors as appropriate to the agenda
   5. Representatives of suppliers and manufacturers as appropriate to the agenda
   6. County MBE/WBE representative
   7. Other agency representatives (FDEP, EPA, City, etc.)
   8. 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/Engineer will schedule progress meetings every month and as required by progress of the Work with the first meeting (one) 1-month after the pre-construction meeting. The Engineer will prepare and distribute the meeting minutes within 7 calendar days.

B. Attendance:
   1. County.
   2. Engineer
   3. Contractor.
   4. Subcontractors as appropriate to the agenda.
   5. Suppliers as appropriate to the agenda.
   6. 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 of Work progress since previous meeting to include current As-Builts
   3. Contractor's/Subcontractor's workforce and equipment.
   4. Progressive As-Built Drawings.
   5. 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).
   6. Field observations, problems and conflicts.
   7. Construction progress and problems which impede construction schedule.
   8. Shop Drawing submittal status.
   9. Requests for Information (RFI) status.
   10. Change order status.
   11. Review of off site fabrication and delivery schedules.
   12. Corrective measures and procedures to regain approved schedule.
   13. Revisions to construction schedule.
   14. Job progress and schedule for succeeding work period.
   15. Coordination of schedules.
   16. Maintenance of quality standards.
   17. Review submittal schedule; expedite as required.
   18. Pending requests for information, changes, and substitutions.
   19. Review proposed changes for effect on construction schedule and completion date.
   20. Pay application status.
   21. Other business.

H. 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

SECTION 01300
SUBMITTALS

PART 1 - GENERAL

No work shall be performed without approved Shop Drawings and/or samples.

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 that 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 5 installations where identical equipment has been installed and has been in operation for a period of at least 1-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 conform(s) to the information in the Contract Documents and is/are 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. No work shall begin without approved shop drawings.

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: 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.

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

L. 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 6-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 of samples specified in the respective Specification section, but no less than two (2). After review one (1) 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 attachment 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 (3) 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 County/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.

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 two (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 or her 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 16 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 Section 01740 "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 1 copy of each digital picture on each of three (3) CDs and provide 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 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 7½-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 (2) 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 orthorectified 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 (3) prints each of the pre and post construction (final completion) orthophoto mosaics, for a total of six (6). 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 (2) 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 with 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 5 copies in addition to any other copies that the Contractor wants returned. The County will retain 5 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 1 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. that may be required by the material or equipment Contactor proposes to supply.

P. On resubmittals, 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
      a. Submit each specification section separately.
      b. Identify each Shop Drawing item required under respective specification section.
      c. 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 checking submittals from 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 County/Professional'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 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 County/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.

END OF SECTION

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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. 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.

C. 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.

D. 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: Days between the Contractors anticipated date for completion of the Work, or of a specified portion of the Work, if any, and the corresponding Contract Time.

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 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 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.

1.05 PROGRESS SCHEDULE SOFTWARE

A. The scheduling software employed by the Contractor to process the Progress Schedule will be the current version of Primavera P6.0®, or Primavera® Contractor 5.0 CPM scheduling software.

B. 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.

1.06 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.

1.07 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 Floats 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.

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

1.09 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.

B. Activities will be detailed to the extent required to show the transition of trade Work. Activities will delineate the progression of the Work.

C. Activities will not combine separate or non-concurrent items of Unit Price or lump sum Work.

D. 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 10 to 40 workdays. Submittal review activity durations shall conform to specified timeframes.

E. Activities will be assigned consistent descriptions and identification codes. Sort codes will group Activities by meaningful schemes.

F. 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.

1.10 FLOAT TOLERANCES AND FLOAT OWNERSHIP

A. Any Progress Schedule with Early Dates after a Contract Time will yield negative Total and Contract Floats, whether shown/calculated or not. Any Revision Submittal with less than negative 20-days of Float will be returned as "Revise and Resubmit," unless a time extension is requested or the County assesses liquidated damages or gives notice of intent to do so, in the event schedule is not recovered.

B. Float calculated from the definitions given in this Section supersede any conflicting Float values in any early completion Progress Schedule.

C. Neither the County nor the Contractor own the Float time, the Project owns the Float time. Neither the County nor the Contractor use of positive Total Float will impact a Contract Completion Date or justify an extension of Contract Time.

1.11 SUBMITTALS

A. Each Progress Schedule Submittal will consist of a narrative, 5 copies of the required reports and plots and an optical ROM data disk with the Contractor's corresponding schedule and schedule layout files in Primavera ".XER" format.

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 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 can not 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

SECTION 01370

SCHEDULE OF VALUES

PART 1 - 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.

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.

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

A. For unit price contracts, the bid item prices on the Project Bid Schedule shall be used as the basis for the schedule of values. The Contractor shall resubmit the bid item prices in the format described herein, and may, at its option, or if requested by the County, divide the items in the Project Bid Schedule into sub-items to provide a more detailed basis of payment.

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. Demolition of existing pump station
   2. Bypass pumping
   3. Wetwell structure, liner, top slab, hatch covers and appurtenances
   4. Valve vault structure, hatch covers and appurtenances, drain piping and appurtenances
   5. Wetwell (mechanical): 316 stainless steel piping and appurtenances, pumps and base plates
   6. Valve vault (mechanical): piping, valves, and appurtenances
   7. Yard piping, fittings, valves, and appurtenances (outside of structures)
   8. Site work and access drive
   9. Chain link fence and gates
   10. Masonry walls and gates
   11. Odor control equipment, piping, monitoring equipment, etc
   12. Generator, fuel storage tank and related piping
   13. Electrical control panel, wiring, and connections
   14. Start-up and testing

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

A. 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 areas of adjacent properties within 100-feet of the limits of Work and 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 lines 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; 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-feet 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 10% 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 centerline 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 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 01390

COLOR DVD
PRECONSTRUCTION RECORD

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: Prior to commencing work, the Contractor shall have a continuous color DVD recording taken along the entire length of the Project and at all proposed construction sites within the Project area to serve as a record of pre-construction conditions.

B. Contractor to lay out Project along with pipe alignment and station points prior to video.

1.02 QUALITY ASSURANCE

A. The Contractor shall engage the services of a professional electrographer. The color DVD shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of preconstruction color DVD documentation.

B. The electrographer shall furnish to the Engineer a list of all equipment to be used for the DVD, i.e., manufacturer's name, model number, specifications and other pertinent information.

C. Additional information to be furnished by the electrographer are the names and addresses of two references that the electrographer has performed color DVD for, on projects of a similar nature, within the last 12 months.

D. Owner's Representative must be present during filming. Provide Owner forty-eight (48) hours' notice prior to start of filming.

E. No construction shall begin prior to review and approval of the DVD covering the construction area by the Owner and Engineer. The Engineer shall have the authority to reject all or any portion of a DVD not conforming to specifications and order that it be redone at no additional charge.

F. The Contractor shall reschedule unacceptable coverage within five (5) days after being notified. The Engineer shall designate those areas, if any, to be omitted from or added to the DVD coverage.

G. DVD shall not be made more than ninety (90) days prior to construction in any area. All DVDs and written records shall become property of Owner.

PART 2 – PRODUCTS

2.01 DVD

A. DVD shall be new. Reprocessed DVDs will not be acceptable.

PART 3 – EXECUTION

3.01 EQUIPMENT

A. All equipment, accessories, materials and labor to perform this service shall be furnished by the Contractor.

B. The total audio-video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruption.

C. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be more than ten (10) feet. In some instances, DVD coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or-special conveyance provided by the Contractor.

D. The color video camera used in the recording system shall have a horizontal resolution of 350 lines at center, a luminance signal to noise ratio of 45 dB and a minimum illumination requirement of one (1) foot candle.

3.02 RECORDED INFORMATION – AUDIO

A. Each DVD shall begin with the current date, project name and municipality and be followed by the general location, i.e., viewing side and direction of progress. The audio track shall consist of an original live recording. The recording shall contain the narrative commentary of the electrographer, recorded simultaneously with his fixed elevation video record of the zone of influence of construction.

B. The Owner and Engineer reserves the right to supplement the audio portion of the DVD as deemed necessary. A representative of the Owner or Engineer shall be selected to provide such narrative.

3.03 RECORDED INFORMATION – VIDEO

A. All video recordings shall, be electronic means, display on the screen the time of day, the month, day and year of the recording. This time and date information must be continuously and simultaneously generated with the actual recording.

B. Each DVD shall have a log of that DVD's contents. The log shall describe the various segments of coverage contained on that DVD in terms of the names of streets or easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering stationing numbers and the date.

3.04 LIGHTING

A. All video shall be done during time of good visibility. No 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.

3.05 SPEED OF TRAVEL

A. The rate of speed in the general direction of travel of the vehicle used during recording shall not exceed 44 feet per minute. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the object.

3.06 AREA OF COVERAGE

A. Video coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing driveways, sidewalks, curbs, pavements, ditches, mailboxes, landscaping, culverts, fences, signs, and headwalls within the area covered, all the way to the right-of-way line and include station points and addresses.

END OF SECTION

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SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 SITE INVESTIGATION AND CONTROL

A. Contractor shall verify all dimensions in the field and check field conditions continuously during construction. Contractor shall be solely responsible for any inaccuracies built into the Work due to Contractor's failure to comply with this requirement.

B. Contractor shall inspect related and appurtenant Work and report in writing to County any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at Contractor's sole cost and expense.

1.02 INSPECTION OF THE WORK

A. The Work shall be conducted under the general observation of representatives of the County acting on behalf of the County to ensure strict compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, shop, or field inspection, as required. The County shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated. Inspection by the County are in addition to the inspections required of Contractor by his or her QC Representatives.

B. The presence of the County, however, shall not relieve the Contractor of the responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the County. Further, no requirement of this Contract may be waived or modified except by change order or formal (written) substitution approval.

C. All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the Work until they have been inspected and accepted by the County. No Work shall be backfilled, buried, cast in concrete, hidden, or otherwise covered until it has been inspected. Any Work so covered in the absence of inspection shall be subject to uncovering. Where uninspected Work cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection and no additional payment will be allowed therefore.

D. The Contractor is responsible for the Quality of his or her own work and shall designate a qualified individual, to be approved by the County, who will ensure that all work is performed in strict accordance with the Contract Documents. This quality representative shall inspect the work for the Contractor and provide to the County and the Contractor a report outlining all work accomplished, all inspections, and all testing performed for all days when work is performed. The objective of this report is to provide "Objective Evidence of Compliance" by the Contractor with the requirements of the Contract.

1.03 TIME OF INSPECTION AND TESTS

A. Samples and testing required under these Specifications shall be furnished and prepared in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. Except as otherwise provided in the Contract Documents, performance of the required tests will be by the Contractor and all costs therefore will be borne by the Contractor at no cost to the County. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under this Contract, the County shall be notified not less than 24-hours in advance to request inspection before beginning any such Work of covering. Failure of the Contractor to notify the County at least 24-hours in advance of any such inspections shall be reasonable cause for the County to order a sufficient delay in the Contractor's schedule to allow time for such inspection, any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the Work, shall be borne by the Contractor.

1.04 SAMPLING AND TESTING

A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the County reserves the right to use any generally accepted system of inspection which, in the opinion of the County, will ensure the County that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief form the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the County shall reserve the right to make independent investigations and tests as specified in the following paragraph and, upon failure of any portion of the Work to meet any of the qualitative requirements of the Contract Documents, shall be reasonable cause for the County to require the removal or correction and reconstruction of any such Work.

D. In addition to any other inspection or quality assurance provisions that may be specified, the County shall have the right to independently select, test, and analyze, at the expense of the County, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Work is discovered, as a result of such independent testing or investigation by the County which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Work shall be borne by the Contractor.

1.05 RIGHT OF REJECTION

A. The County shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If the County or inspector, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by County.

B. Contractor shall promptly remove rejected articles or materials from the site of the Work after notification or rejection.

C. All costs of removal and replacement of rejected articles or materials, as specified herein, shall be borne by the Contractor.

D. If the Contractor fails to remove or replace defective work after notification to do so, the County may have the work removed and replaced by others and deduct all costs from the Contractor's pay requests.

1.06 TESTING LABS

A. All geotechnical testing laboratory services for field testing will be paid by the County. The lab(s) shall function as independent lab(s) and report independently to the County and the Contractor. The test lab(s) may not approve or allow any deviation from the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. County will employ, and pay for 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. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.
   3. Employment of laboratory by County shall in no way relieve Contractor's obligations to perform the Work of the Contract.

B. Related Requirements Described Elsewhere:
   1. Conditions of the Contract.
   2. Respective section of Specifications: Certification of products.
   3. Each Specification section listed: Laboratory tests required, and standards for testing.

1.02 LABORATORY DUTIES: LIMITATIONS OF AUTHORITY

A. Submit 5 copies of inspection reports to the County. The reports shall include the following components:
   1. Project title and County’s project number
   2. Testing laboratory name and address
   3. Date of report issuance
   4. Name and signature of field technician
   5. Date of inspections, sampling, and/or testing
   6. Record of weather conditions
   7. Identification of product tested and associated specification section
   8. Testing location
   9. Description of testing performed
   10. Observations made regarding compliance with the Contract Documents

B. Laboratory is not authorized to:
   1. Release, revoke, alter, or enlarge on requirements of Contract Documents
   2. Approve or reject any portion of Work
   3. Perform any duties of the Contractor

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with County's personnel; provide access to Work and manufacturer's operations.

B. Secure and deliver to the County adequate representational samples of materials proposed to be used and which require testing.

C. Provide to the County the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacturer or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The County may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the County shall be allowed on account of such testing and certification.

E. Contractor shall not have direct contact with laboratory or laboratory personnel. All testing shall be coordinated through County.

F. Furnish incidental labor and facilities:
   1. To provide access to Work to be tested.
   2. To obtain and handle samples at the Project site or at the source of the product to be tested.
   3. To facilitate inspections and tests.
   4. For storage and curing of test samples.

G. Notify County 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 due to Contractor's negligence.

H. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience.

I. If the test results indicate the material or equipment complies with the Contract Documents, the County shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor shall pay for the laboratory costs directly to the County or the total costs shall be deducted from any payments due to the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work Included: Provide temporary facilities and controls needed for the Work, including, but not necessarily limited to:
   1. Temporary utilities such as water, electricity, and telephone;
   2. Field office for the Contractor's personnel;
   3. Sanitary facilities; and
   4. Enclosures such as tarpaulins, barricades, fences, canopies; traffic control and pedestrian control devices.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Except that equipment furnished by subcontractors shall comply with requirements of pertinent safety regulations, such as equipment normally furnished by the individual trades in execution of their own portions of the Work are not part of this Section.
   3. Permanent installation and hookup of the various utility lines are described in other Sections.

1.02 PRODUCT HANDLING

A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

PART 2 – PRODUCTS

2.01 UTILITIES

A. Water:
   1. Provide necessary temporary piping and water supply, and upon completion of the Work, remove such temporary facilities.

B. Electricity:
   1. Provide necessary temporary wiring, and upon completion of the Work, remove such temporary facility.
   2. Provide area distribution boxes so located that the individual trades may furnish and use 100-foot maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.

3. All electric power necessary for construction and for testing of Project mechanical and electrical systems will be furnished and paid for by the Contractor. The point(s) of tie-in shall be coordinated with Orlando Utilities Commission.
    a. All temporary wiring provided by the Contractor must conform to the requirements of the National Electric Code, the Industrial Safety Commission and local requirements. In addition, all wire used shall be fused to adequately protect that wire according to the Code.
    b. The Contractor shall have an adequate number of outlets and each outlet shall be properly and clearly labeled with the maximum voltage and fuse protection.
    c. Where temporary lighting is used, outlets shall consist of a weatherproof socket properly insulated and provided with a locking type wire guard.
    d. All devices shall be properly grounded.

C. Sanitary Facilities:
    1. Provide temporary sanitary facilities for use by all of Contractor's personnel.
    2. Maintain in a sanitary condition at all times.
    3. The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the regulations of the State Board of Health.

2.02 ENCLOSURES

A. Provide and maintain for the duration of construction all tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

END OF SECTION

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

C. Netting: Polypropylene mesh netting 5/8-inch x ¾-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: Clean, synthetic hay type. 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 Section 02578 "Solid Sodding."

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 (Stormwater 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 1 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, 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 (1) coat of primer and two (2) 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.

D. Contractor provision of field offices for the County.

E. Restrictions on the use of existing adjacent facilities.

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 and distribution boxes located as required. 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 two (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°F and maximum relative humidity of 50% 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. Adjacent County office building toilet facilities are not to be used by Contractor.

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; provided 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 existing buildings. Construction activities will not interfere with access. If Contractor fails to maintain public 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. Construct and maintain temporary roads accessing public thoroughfares to serve Construction area.

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

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

E. 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.

1.12 FIELD OFFICES (FOR UTILITIES DEPARTMENT)

A. No work shall be performed until office trailer is completely setup. The Contractor will provide and maintain 1 field office for the use of the County until Substantial Completion.

B. The field offices will be an appropriate size required for the use of the County, as well as contain two offices and three desks. The field office structure will be a minimum of 10-feet x 40-feet. The layout of the County's field office will include adequate space to hold project meetings (minimum seating for 15).

C. Installation of the field offices will meet all local codes and ordinances. The Contractor will as a minimum install the structures on a level, well-drained area. Structures will be designed and installed to resist 130-mph winds or applicable State of Florida code, whichever is more stringent.

D. The field offices will be provided with structurally sound and safe steps and landings for each door. The doors will have secure locks. Construct appropriate walkway and landings. Construct covers over each door that extends 3-feet from the building and the full width of the landing.

E. The field offices will be designated as a "No Smoking Area."

F. The windows will be arranged for cross ventilation with screens.

G. Provide air conditioning and heating systems with thermostat control.

H. Provide electric power for the duration of the Work.

I. The Contractor will provide the following with the field office, at a minimum:
   1. Electric lights (fifty (50) foot-candles at desktop height) and power supply outlets.
   2. When available, provide high-speed Internet access to all desks for the duration of the Work.
   3. Acceptable toilet facilities with appropriate signage that meet all of the local and State health codes and regulations.
   4. Fire extinguisher (Halon type, minimum 4 lb. capacity).
   5. Water coolers, bottled water and paper cups.
   6. Tables for viewing the Project Drawings.
   7. Standard office supplies.
   8. Weekly janitorial services.

1.13 SPECIFIC REQUIREMENTS FOR THE FIELD OFFICES

Provide the following for the exclusive use of the County:

A. Office Furnishings: The furniture will be delivered and placed as directed by the County. Office furnishings need to be in good condition.

B. Desks: Flat top, double pedestal, with one box and one file drawer in each pedestal, 60-inches by 30-inches. Total quantity will be three (3).

C. Chairs: Three (3) office-type chairs, adjustable heights, on rollers, with armrests.

D. Conference Table and Chairs: One (1) table (3-feet by 8-feet minimum), scratch and stain resistant and 15 meeting-type chairs.

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

F. Printer: One(1) – All in one color inkjet printer capable of printing, scanning and coping Ledger, Legal and Letter sizes. Standard interfaces shall include Hi-Speed USB 2.0, Wireless (802.11b/g/n), Ethernet. Minimum requirements include: 35 page automatic document feeder, printing 20 color copies per minute at 6000 x 1200 dpi resolution, scan resolution 2400 x 2400 dpi, flat bed document glass size Ledger (11" x 17") with standalone copy features, minimum of 250 sheet input capacity cassettes and 2 additional complete set of ink cartridges. Brother MFC-J6710DW or equal. Printers to be retained by the County. 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.
   1. Provide Internet connection in each of the four offices in the field trailer. The connection shall be at least 5.0 Mbps of download speed or greater. Provide office with a wireless network 802.11 n with minimum of 8 concurrent users in addition to the network requirements. Wireless network shall allow additional portable computers to gain internet access within the office.

H. 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 stands, 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, 34½-inches wide by 12-5/8-inches deep by 71-inches high, color to be selected by the Engineer.

I. Miscellaneous Field Supplies:
   1. One (1) minimum/maximum digital thermometer, with batteries for the duration of the Work.
   2. One (1) rain gauge.

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

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 1-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 1-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 7-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 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 maximum moisture content is specified in an area where 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 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 01650

START-UP AND DEMONSTRATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. Demonstrate to Owner and Engineer that the Work functions as a complete and operable system under normal and emergency operating conditions.
   2. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

B. Contractor shall provide all chemicals, materials, personnel, equipment and expendables as needed and as specified to perform the required start-up and demonstration tests. Contractor shall provide all chemicals for testing and refill all tanks at the end of testing. Chemicals and materials shall comply with FDEP and AWWA requirements.

C. Related Work Described Elsewhere:
   1. Progress Schedules: Section 01310.
   2. Operating and Maintenance Data: Section 01730.
   3. Equipment: Division 11.
   4. Mechanical: Division 15.
   5. Electrical: Division 16.

PART 2 – PRODUCTS

2.01 START-UP PLAN

A. Submit for approval by the Engineer a detailed start-up plan outlining the schedule and sequence of all tests and start-up activities, including submittal of checkout forms, submittal of demonstration test procedures, start-up, demonstration and testing, submittal of certification of completed demonstration and training. Start-up and commissioning may not begin until the plan is approved by the Engineer.

PART 3 – EXECUTION

3.01 COMPONENT TEST AND CHECK-OUT

A. Start-up Certification: Prior to system start-up, successfully complete all the testing required of the individual components of the Work. Submit six (6) copies of CHECK-OUT MEMOS for each individual component or piece of equipment, signed by the Contractor or the subcontractor and the manufacturer's representative. All copies of the Operation and Maintenance Manuals must be provided before start-up may begin. These forms shall be completed and submitted before Instruction in Operation to Owner or a request for initiating any final inspections. Insert one (1) copy of this form into the applicable section of each Operation and Maintenance Manual.

B. Demonstrate to the Engineer and the Owner's representative, that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designated.

C. Coordinate start-up activities with the Owner's operating personnel at the treatment plant site and with the Engineer prior to commencing system start-up.

3.02 START-UP

A. Confirm that all equipment is properly energized, that the valves are set to their normal operating condition and that the flow path through the new Work is unobstructed.

B. Slowly fill each hydrostatic structure in the process flow stream with water.

C. Initiate start-up and training in accordance with and with the use of the plant operation and maintenance manuals.

D. Observe the component operation and make adjustments as necessary to optimize the performance of the Work.

E. Coordinate with Owner for any adjustments desired or operational problems requiring debugging.

F. Make adjustments as necessary.

3.03 START-UP DEMONSTRATION AND TESTING

A. After all Work components have been constructed, field tested, and started up in accordance with the individual Specifications and manufacturer requirements, and after all Check-Out Forms have been completed and submitted, perform the Start-Up Demonstration and Testing. The demonstration period shall be held upon completion of all systems at a starting date to be agreed upon in writing by the Owner or the Owner’s representative. Prior to beginning the start-up demonstration testing, the Contractor shall submit a detailed schedule of operational circumstances for approval by the Engineer. The schedule of operational circumstances shall describe, in detail, the proposed test procedures for each piece of equipment. Provide similar test procedure forms for each piece of equipment or section of the Work to include all particular aspects and features of that equipment or section of the Work and as specified in the Technical Sections of the Specifications.

B. The Start-Up Demonstration Testing will be conducted for two (2) weeks. The Work must operate successfully during the two (2) week testing period in the manner intended. If the Work does not operate successfully, or if the start-up is interrupted due to other contracts, the problems will be corrected and the test will start over from day one. The party causing the interruption will be subject to the assessment of actual damages due to delay.

C. During the start-up demonstration period, operate the Work, coordinate with designated plant operating personnel in the function and operation of the Work, and demonstrate various operational circumstances. As a minimum, these circumstances will include average and peak daily flows, random equipment or process failures, tank overflows,

surcharges, interlocks and bypasses. Demonstrate the essential features of the equipment and its relationship to other equipment. The approved schedule of operational circumstances and Demonstration Test Procedures Forms will be used as the agenda during the Start-Up Demonstration Testing period for all equipment and sections of the Work. Coordination of the demonstration test content and schedule will be accomplished through the Engineer and the County Operations staff.

D. Contractor shall be responsible for the discharge of all water during start-up testing.

E. Acceptability of the Work's performance will be based on the Work performing as specified under these actual and simulated operating conditions, to provide water treatment facilities functioning as intended and as defined in the Contract Documents. The intent of the start-up demonstration and testing is for the Contractor to demonstrate to the Owner and the Engineer that the Work will function as a complete and operable system under normal, as well as emergency operating conditions, and is ready for final acceptance.

F. Demonstrate the essential features of all the mechanical systems including, but not limited to, the following as they apply to the Work. Each system shall be demonstrated once only, after completion of testing.
   1. Chemical Feed Systems.
   2. Mechanical Systems
      a. Valves
      b. Pumps
   3. Heating, Air Conditioning, and Ventilating Systems and Controls.
      a. Air Conditioning/Heating System
      b. Ventilating System

G. Demonstrate the essential features of all electrical and instrumentation systems including, but not limited to, the following as they apply to the work:
   1. Electrical systems controls and equipment:
      a. Electrical power equipment.
      b. Motor control centers.
      c. Motor control devices.
      d. Relays.
      e. Special transformers.
      f. Starting devices.
   2. Supervisory control and data acquisition system.
   3. Communications systems.
   4. Lighting fixtures (including re-lamping and replacing lenses):
      a. Exit and safety fixtures.
      b. Fixtures, indoor and outdoor.
      c. Floodlighting.
   5. Panelboards:
      a. Distribution panels.
      b. Lighting panels.
      c. Main panels, power panels.
      d. Switchboard.
   6. Transfer switch (manual).
   7. Wiring devices:
      a. Face plates.

b. Low-voltage controls.
c. Outlets: convenience, special purpose.
d. Switches: regular, time

H. Upon completion of all operator training, the Contractor shall submit to the Engineer six (6) copies of the Certificate of Completed Demonstration Form, for each item of equipment or system in the Work, signed by the Contractor, Subcontractor, Engineer, and the Owner. Insert one (1) copy of this form in the applicable section of each Operation and Maintenance Manual. A sample Certificate of Completed Demonstration Form will be provided at the Preconstruction Meeting.

3.04 INSTRUCTION OF OWNER'S PERSONNEL

A. Upon successful completion of the Component Testing and Check out and prior to the Start-up, Demonstration and Testing, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment, and systems. Training of the Owner's personnel will not be considered valid unless it takes place using a system that is fully operational

B. The operating and maintenance manual shall constitute the basis of instruction. Review contents of manual with Owner's operating and maintenance personnel in full detail to explain all aspects of operations and maintenance.

C. Instructors shall be fully qualified personnel as outlined within the individual equipment specifications. If no specific training specifications are listed with the equipment, the Contractor shall provide the instruction with qualified Contractor personnel.

D. Contractor shall coordinate with Owner to create a list and schedule indicating the date, time, and instructors that will be present for all training sessions.

E. The instructors shall provide for and prepare lesson scopes and handouts for up to ten (10) individuals designated by the Owner that outline the items to be covered. Separate sessions for operation and maintenance instruction shall be provided consecutively. Handouts shall be submitted to the Owner with at least one week's notice prior to the training sessions.

F. Upon successful completion of the Start-up, Demonstration and Testing, the Owner's personnel will receive the specified training for each system. Training of the Owner's personnel will not be considered valid unless it takes place using a system that has successfully passed the Start-up, Demonstration and Testing. Training shall be a minimum of two (2) days for each system, unless the individual equipment specification requires more. All training required by the specifications shall be videotaped with approved equipment and microphones in accordance with Section 01390 and shall be submitted to the County on individual writable DVDs for review and approval.

I. Training for Instrumentation and Controls shall include a minimum of 8 hours onsite for two (2) separate groups of staff and 8 hours at the Eastern Regional Water Supply Facility.

END OF SECTION

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

A. 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 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 Section 01740 "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.

I. Complete final cleaning requirements necessary for Substantial Completion.

1.05 FINAL CLEANING.

Complete the following cleaning operations prior to Substantial Completion or Owner 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 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. Owner'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 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 punched, 8½-inch x 11-inch sheets or on three-hole punched sheets that are foldable in multiples of 8½-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 (1) 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.

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.

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 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.

1.04 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

OPERATING AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.
      a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
   2. Provide manuals in paper and electronic formats.
   3. Provide manuals for use in instructing Owner’s personnel pursuant to Section 01650 Startup Demonstration and Testing.

B. Related Requirements Described Elsewhere:
   1. General Requirements: Division 1
   2. Equipment: Division 11
   3. Special Construction: Division 13
   4. Mechanical: Division 15
   5. Electrical: Division 16

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:
   1. Trained and experienced in maintenance and operation of described products.
   2. Familiar with requirements of this Section.
   3. Skilled as technical writer to the extent required to communicate essential data.
   4. Skilled as draftsman competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

A. Paper Operation and Maintenance Manuals:
   1. Size: 8½ inches x 11 inches.
   2. Paper: 20 pound minimum, white, for typed pages.
   3. Text: Manufacturer's printed data, or neatly typewritten.
   4. Drawings:
      a. Provide reinforced punched binder tab, bind in with text.
      b. Reduce larger drawings and fold to size of text pages but not larger than 14 inches x 17 inches.
   5. Provide fly-leaf for each separate product, or each piece of operating equipment.
      a. Provide typed description of projects and major component parts of equipment.
      b. Provide identified tabs.
   6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
      a. Title of Project.

b. Identity of separate structure as applicable.
c. Identity of general subject matter covered in the manual.

7. Binders: Commercial quality, three D-ring binders with durable and cleanable white plastic covers. Binders shall be presentation type with clear vinyl covers on front, back, and spine. Binders shall include two sheet lifters and two horizontal inside pockets. Maximum D-ring width: 2 inches. When multiple binders are used, correlate the data into related consistent groupings.

B. Electronic Operation and Maintenance Manuals.

1. Electronic manuals shall be in Adobe Acrobat's Portable Document Format (PDF), and shall be prepared at a resolution of 300 dots per inch (dpi) or greater, depending on document type. Optical Character Recognition (OCR) capture shall be performed on these documents. OCR settings shall be performed with the "original image with hidden text" option in Adobe Acrobat Exchange.
2. When multiple files are required the least number of files possible shall be created. File names shall be in the format OMXXXXX-YYYZ-V.pdf, where XXXXX is the five digit number corresponding to the specification section, YYY is a three digit O&M manual number, e.g. 001, Z is the letter signifying a resubmittal, A, B, C, etc, and V is a number used only when more than one file is required for an O&M manual.
3. Documents prepared in PDF format shall be processed as follows:
   a. Pages shall be searchable (processed for optical character recognition) and indexed when multiple files are required.
   b. Pages shall be rotated for viewing in proper orientation.
   c. A bookmark shall be provided in the navigation frame for each entry in the Table of Contents.
   d. Embedded thumbnails shall be generated for each completed PDF file.
   e. The opening view for PDF files shall be as follows:
      Initial View: Bookmarks and Page
      Page Number: Title Page (usually Page 1)
      Magnification: Set to Fit in Window
      Page: Single Page
   f. Where the bookmark structure is longer than one page the bookmarks shall be collapsed to show the chapter headings only.
   g. When multiple files are required the first file of the series (the parent file) shall list every major topic in the Table of Contents. The parent file shall also include minor headings bookmarked based on the Table of Contents. Major headings, whose content is contained in subsequent files (children) shall be linked to be called from the parent to the specific location in the child file. The child file shall contain bookmark entries for both major and minor headings contained in the child file. The first bookmark of any child file shall link back to the parent file and shall read as follows "Return to the Equipment Name Table of Contents", e.g. Return to the Polymer Feed System Table of Contents.
   h. Drawings shall be bookmarked individually.
   i. Files shall be delivered without security settings to permit editing, insertion and deletion of material to update the manual provided by the manufacturer.
4. Provide each copy on an individual CD-ROM or DVD labeled with title "OPERATING AND MAINTENANCE INSTRUCTIONS", title of project, identity

of separate structure as applicable and identity of general subject matter covered in the manual.

1.04 CONTENT OF MANUAL

A. Copy of each warranty, bond and service contract issued. Include warranty at the front of each manual.
   1. Provide information sheet for Owner's personnel. Give:
      a. Contact information including name, address, email address and phone numbers
      b. Proper procedures in event of failure.
      c. Instances which might affect validity of warranties or bonds.

B. Neat table of contents for each volume, arranged in systematic order.
   1. Contractor, name of responsible principal, address and telephone number.
   2. A list of each product required to be included, indexed to content of the volume.
   3. List, with each product, name, address and telephone number of:
      a. Subcontractor, manufacturer, and installer name, addresses, and telephone numbers.
      b. A list of each product required to be included, indexed to content of the volume.
      c. Identify area of responsibility of each.
      d. Local source of supply for parts and replacement equipment including name, address, and telephone number.
   4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

C. Product Data:
   1. Include only those sheets that are pertinent to the specific product.
   2. Annotate each sheet to:
      a. Clearly identify specific product or part installed.
      b. Clearly identify data applicable to installation.
      c. Delete references to inapplicable information.
   3. Operation and maintenance information as herein specified.
   4. Record shop drawings as submitted and approved with all corrections made for each product.

D. Drawings:
   1. Supplement product data with drawings as necessary to clearly illustrate:
      a. Relations of component parts of equipment and systems.
      b. Control and flow diagrams.
   2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
   3. Do not use Project Record Documents as maintenance drawings.

E. Written test, as required to supplement product data for the particular installation:
   1. Organize in consistent format under separate headings for different procedures.
   2. Provide logical sequence of instruction of each procedure.

1.05 MANUAL FOR MATERIALS AND FINISHES

A. Content for architectural products, applied materials, and finishes:
   1. Manufacturer's data, giving full information on products.
      a. Catalog number, size, and composition.
      b. Color and texture designations.
      c. Information required for reordering special manufacturing products.
   2. Instructions for care and maintenance.
      a. Manufacturer's recommendation for types of cleaning agents and methods.
      b. Cautions against cleaning agents and methods which are detrimental to product.
      c. Recommended schedule for cleaning and maintenance.

B. Content for moisture protection and weather-exposed products:
   1. Manufacturer's data, giving full information on products.
      a. Applicable standards.
      b. Chemical composition.
      c. Details of installation.
   2. Instructions for inspection, maintenance, and repair.

C. Additional requirements for maintenance data: Respective sections of Specifications.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each unit of equipment and system, as appropriate:
   1. Description of unit and component parts.
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and commercial number of replaceable parts.
      d. Summary of information listed on equipment and motor data plates.
   2. Operating procedures:
      a. Start-up, break-in, routine, and normal operating instructions.
      b. Regulation, control, stopping, shut-down, and emergency instructions.
      c. Summer and winter operating instructions.
      d. Special operating instructions.
   3. Maintenance procedures:
      a. Routine operations.
      b. Guide to troubleshooting.
      c. Disassembly, repair, and reassembly.
      d. Alignment, adjusting, and checking.
   4. Servicing and lubrication required.
   5. Manufacturer's printed operating and maintenance instructions.
   6. Description of sequence of operation by control manufacturer.
   7. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
      a. Predicted life of parts subject to wear.
      b. Items recommended to be stocked as spare parts.
   8. As-installed control diagrams by controls manufacturer.
   9. Each Contractor's coordination drawings.
      a. As-installed color-coded piping diagrams.

10. Charts of valve tag numbers with location and function of each valve.
11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
12. Other data as required under pertinent sections of specifications.
13. Approved record shop drawings with all corrections made and a copy of the warranty statement, checkout memo, demonstration test procedures, and demonstration test certification.

B. Content for each electric and electronic systems, as appropriate:
   1. Description of system and component parts.
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and commercial number of replaceable parts.
   2. Circuit directories and panelboards.
      a. Electrical service.
      b. Controls.
      c. Communications.
   3. As installed color-coded wiring diagrams.
   4. Operating procedures:
      a. Routine and normal operating instructions.
      b. Sequences required.
      c. Special operating instructions.
   5. Maintenance procedures:
      a. Routine operations.
      b. Guide to troubleshooting.
      c. Disassembly, repair, and reassembly.
      d. Adjustment and checking.
   6. Manufacturer's printed operating and maintenance instructions.
   7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
   8. Other data as required under pertinent sections of specifications.

C. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

D. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.07 SUBMITTAL SCHEDULE

A. Submit two (2) paper copies and two (2) electronic copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 90 days after Notice to Proceed.

B. Submit two (2) paper copies and two (2) electronic copies of completed data in preliminary form no later than 20 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01340, but no later than delivery of equipment. One (1) copy will be returned with comments to be

incorporated into the final copies and the other copy will be retained on-site for use in any early training.

C. Submit six (6) paper copies and four (4) electronic copies of approved manual in final form directly to the offices of the Engineer within 10 days after the reviewed copy or last item of the reviewed copy is returned.

D. Provide six (6) copies of addenda to the operation and maintenance manuals as applicable and certificates as specified within 30 days after final inspection.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

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 Divisions 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, with thickness as necessary to accommodate contents and sized to receive 8½-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, the name of the product or work item, contact name and phone number, warrantee periods and dates.
   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, warrantee period with dates.
   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 three-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 that lists for more than $1,000.00.

B. In the event that an equipment manufacturer or supplier is unwilling to provide a three-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 3-years 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 (NOT USED)

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DIVISION 2
SITE WORK

SECTION 02050

DEMOLITION OF EXISTING STRUCTURES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. This Section specifies the labor, materials, equipment, and incidentals required for the demolition, relocation, and/or disposal of all structures, building materials, equipment, and accessories to be removed as shown on the Drawings and as specified herein.
   2. Complete or partial demolition and removal of existing structures and equipment includes, but is not limited to, chemical bulk storage and day tanks; piping and pipe supports; valves; mixing pumps; equipment pads; foundations; concrete slabs; and mechanical, electrical, and instrumentation equipment related to the Work as shown on the Drawings and specified herein. Complete demolition and removal of existing caustic building and equipment as shown on Drawings.
   3. There may be existing and active stormwater, wastewater, water, and other facilities on site as indicated on the Drawings. It is essential that these facilities, when encountered, remain intact and in service during the proposed demolition. Consequently, the Contractor shall be responsible for the protection of these facilities and shall diligently direct all activities toward maintaining continuous operation of the existing facilities and minimizing operational inconvenience.
   4. The Contractor shall be responsible for:
      a. Approximate locations and dimensions of piping and structures are shown in the Contract Drawings demolition plans.
      b. All piping and equipment to be demolished associated with the Water Supply Facility Chemical System Improvements shall be demolished and removed according to this Specification.
      c. Capping of all water piping.
      d. Locate and coordinate with Owner existing electrical and control systems in vicinity of or routed through structures to be demolished. Install bypass and protect these systems as required.
      e. Termination of all electric facilities in accordance with local codes and NEC.
      f. Final grading and site restoration.
      g. Disposal of non-salvageable and excess unacceptable materials as specified below.
      h. All concrete tankage and slabs shall be removed before filling and compacting the depression with clean fill.
      i. Water service shall not be disturbed, irrigation piping shall not be disturbed, and overhead electric shall not be disturbed.
   5. Contractor shall examine the various Drawings, visit the site, and determine the extent of the work, the extent of work affected therein, and all conditions that are required to perform the various operations.

1.02 QUALITY ASSURANCE

A. Permits and Licenses: Contractor shall obtain all necessary permits and licenses for performing the Work and shall furnish a copy of same to the Owner prior to commencing the Work. The Contractor shall comply with the requirements of the permits.

B. Utility Services: Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone, or sewer service to remove any equipment running to the facilities to be demolished and to remove, disconnect, cap, or plug their services to facilitate demolition.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submit to the Engineer for approval two (2) copies of the proposed demolition and removal plan for the structures and modifications as shown on the Drawings or as specified herein prior to the start of work. Include in the schedule the coordination of shutoff, capping and continuation of service as required. The demolition and removal plan shall include the following as a minimum:
   1. A detailed sequence of demolition and removal work to insure the uninterrupted progress of the Owner's operations and the expeditious completion of the Contractor's work.
   2. Evidence (by signature) of approval of the Owner's Representative of the work plan.

B. Before commencing demolition work, all modifications necessary to bypass the affected structure will be completed. Contractor shall coordinate with the Owner's personnel to determine the locations of the affected valves and fittings.

1.04 SITE CONDITIONS

A. The Owner assumes no responsibility for the actual condition of the structures to be demolished or relocated.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable; however, variations within each site may occur prior to the start of demolition work.

C. No additional payment will be made for pumping or other difficulties encountered due to water.

D. Certain information regarding the reputed presence, size, character, and location of existing underground structures, pipes, and conduit has been shown on the Drawings. The accuracy of this information is not certain and the location of underground structures shown may be inaccurate and other obstructions than those shown may be encountered. Contractor hereby distinctly agrees that Owner is not responsible for the correctness or sufficiency of the information given; that this information is not to be considered as a part of the Contract; that Contractor shall have no claim for delay or extra compensation due to incorrectness of information regarding obstructions either revealed or not revealed by the Drawings; and that Contractor shall have no claim for relief from any obligation or

responsibility under this Contract in case the location, size, or character of any pipe or other underground structure is not as indicated on the Drawings, or in case any pipe or other underground structure is encountered that is not shown on the Drawings.

1.05 RESTRICTIONS

A. No building, tank or structure, or any part thereof, shall be demolished until an application has been filed by the Contractor with the Building Department Inspector and a permit issued if a permit is required. The fee for this permit shall be the Contractor's responsibility. Demolition shall be in accordance with applicable provisions of the Building Code of the State of Florida.

B. No explosives shall be used at any time during the demolition. No burning of combustible material will be allowed.

1.06 DISPOSAL OF MATERIAL

A. Salvageable material shall become the property of the Owner if the Owner requests any specific item. Contractor shall dismantle all materials to such a size that it can be readily handled, and deliver any of this salvageable material requested by the Owner to a storage area on site designated by the Owner.

B. The following type of materials are examples of what the Owner desires to keep or salvage:
   1. equipment and instrumentation as designated by Owner.

C. Any materials that the Owner rejects shall become the Contractor’s property and must be removed from the site.

D. Concrete, concrete block, and non-salvageable bricks shall be hauled to a waste disposal site by the Contractor.

E. All other material shall be hauled to a waste disposal site by the Contractor.

F. The storage or sale of removed items on the site will not be allowed.

G. Contractor is responsible for the dewatering and disposal of all liquids and chemicals in f pipelines, sumps, tanks,etc..

1.07 TRAFFIC AND ACCESS

A. Conduct work to ensure minimum interference with on-site and off-site roads, streets, sidewalks, and occupied or used facilities.

B. Special attention is directed towards maintaining safe and convenient access to the existing facilities remaining in operation by plant personnel and plant associated vehicles, including trucks and delivery vehicles.

C. Do not close or obstruct streets, sidewalks, or other occupied or used facilities without permission from the Owner. Provide alternate routes around closed or obstructed traffic in access ways.

1.08 PROTECTION

A. Conduct operations to minimize damage by falling debris or other causes to adjacent buildings, structures, roadways, other facilities, and persons. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain.

1.09 DAMAGE

A. Promptly repair damage caused to adjacent facilities by demolition operations as directed by the Owner at no cost to the Owner.

1.10 UTILITIES

A. Maintain existing utilities as directed by the Owner to remain in service and protect against damage during demolition operations.

B. Do not interrupt existing utilities serving occupied or operational facilities, except when authorized by Owner. Provide temporary services during interruptions to existing utilities as acceptable to the Owner.

C. Contractor shall cooperate with the Owner to shut off utilities serving structures of the existing facilities as required by demolition operations.

D. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the interruption of all public and private utilities or services.

E. All utilities being abandoned shall be terminated at the service mains in conformance with the requirement of the utility companies or the municipality owning or controlling them.

1.11 EXTERMINATION

A. If required, before starting demolition, the Contractor shall employ a certified rodent and vermin exterminator and treat the facilities in accordance with governing health laws and regulations. Any rodents, insects, or other vermin appearing before or during the demolition shall be killed or otherwise prevented from leaving the immediate vicinity of the demolition work.

1.12 POLLUTION CONTROL

A. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust rising and scattering in the air to the

lowest level of air pollution practical for the conditions of work. The Contractor shall comply with the governing regulations.

B. Clean adjacent structures and improvements of all dust and debris caused by demolition operations as directed by the Owner. Return areas to conditions existing prior to the start of work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SEQUENCE OF WORK

A. The sequence of demolition and relocation of existing facilities shall be in accordance with the approved critical path schedule as specified in paragraph 1.03 above.

3.02 REMOVAL OF EXISTING PROCESS EQUIPMENT, PIPING, AND APPURTENANCES

A. Existing equipment, piping, buried and non-buried valving, and appurtenances shall be removed as shown or dictated or the Drawings, and/or specified herein.

B. All equipment piping and appurtenances shall be cleaned, flushed, and drained. Equipment to be retained by the Owner as specified in Paragraph 1.05 above shall be dismantled sufficiently to permit thorough cleaning and draining. All valves shall be left open. All abandoned piping shall be capped and sleeves and openings remaining after removal of the existing equipment, piping, and appurtenances shall be plugged and sealed as shown on the Drawings, and/or specified herein.

C. **Extreme Caution must be used while handling hydrofluorocilisic acid.**

3.03 DEMOLITION PROCEDURES

The Contractor shall adhere to the following demolition procedures as referenced on the Drawings:

A. DEMOLISH: Where indicated on the Drawings, the structures and equipment shall be completely removed from the site with all associated connecting piping or electrical service. The item shall be taken whole or in parts to be salvaged or disposed of by the Contractor as specified in Section 1.06. Where indicated on the Drawings, pipe (and conduit) shall be drained and the contents properly disposed. The pipe (or conduit) shall then be completely removed from the site, including fittings, valves, and other in-line devices. Connections to existing piping to remain shall be plugged by mechanical means (M.J. plugs, tie-rods, or thrust blocks).

B. The Contractor shall use Extreme caution when dealing with Hydrofluorosilicic Acid. The Contractor must flush, wash, and dispose of any Hydrofluorosilicic Acid and materials used for cleaning Hydrofluorosilicic Acid in accordance with all federal, state

and local laws using an approved hazardous chemical contractor.

C. PROTECT: Where indicated on the Drawings, the designated facilities shall remain intact and protected during the prosecution of the demolition work. If facilities and equipment are not designated for removal/demolition, they shall remain and be protected accordingly.

D. RELOCATE: Where indicated on the Drawings, the designated facilities shall be completely removed, intact, and relocated on site. Connected piping or conduit shall be drained and contents properly disposed.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide clearing, grubbing, and stripping within the construction sites, complete as specified herein.

B. The Contractor shall clear and grub all of the area within the limits of construction and as required to complete the Work. Prior to the beginning of any clearing, the County shall accept the width of the area to be cleared.

C. The Contractor's attention is directed to any soil erosion and sediment control ordinances in force. The Contractor shall comply with all applicable sections of these ordinances.

1.02 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 (NOT USED)

PART 3 - EXECUTION

3.01 CLEARING

A. Perimeter controls shall be installed prior to initiating clearing in accordance with the approved Erosion Control Plan or SWPPP.

B. Surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish, and all other objectionable obstructions resting on or protruding through the surface of the ground. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others.

C. Where construction necessitates the removal of trees, the Contractor shall obtain all required permits. Removal of trees shall be only as directed by the County. As determined by the County, where excavation, tree removal, stripping, or trimming may result in damage to existing trees, shrubs, or bushes, the Contractor shall employ a licensed tree surgeon/service to oversee the Work and provide protection of the trees. The tree surgeon/service shall submit a detailed plan of action to the County prior to any work.

3.02 GRUBBING

A. Perimeter controls shall be installed prior to initiating grubbing in accordance with the approved Erosion Control Plan or SWPPP.

B. Grubbing shall consist of the complete removal of all stumps, roots larger than 1½-inches in diameter, matted roots, brush, timber, logs, and any other organic or metallic debris not suitable for foundation purposes which are resting on, under or protruding through the surface of the ground, removal shall be to a depth of 18-inches below the sub grade. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.03 STRIPPING

A. Topsoil shall be stockpiled as directed by the County. Stockpiled topsoil shall be protected until it is placed as specified. The Contractor shall dispose of any topsoil remaining after all work is in place, unless directed otherwise by the County.

3.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

A. The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. Disposal by burning and burial will not be permitted. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the Contract Price.

B. If the County desires the timber or small trees, the Contractor shall cut and neatly pile it in 4-foot lengths for removal by the County; otherwise, the Contractor shall dispose of it by hauling it away from the project site.

3.05 PRESERVATION OF TREES

A. Those trees designated for preservation by the County shall be carefully protected from damage. The Contractor shall erect barricades, guards, and enclosures as required for the protection of the trees during all construction operations.

3.06 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property as applicable. Trees, shrubbery, gardens, lawns, and other landscaping that, in the opinion of the County must be removed, shall be replaced and replanted to restore the area to the condition existing prior to construction. Such work shall be at no additional cost to the County.

B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.

C. Improvements to the land such as fences, walls, outbuildings, and other structures that, of necessity, must be removed shall be replaced with equal quality materials and labor at no additional cost to the County.

D. The Contractor shall clean up and restore the construction site/areas adjacent to developed private property immediately after construction is completed.

3.07 PRESERVATION OF AGRICULTURAL PROPERTY

A. When the route of the construction crosses agricultural property, pastures, fields under cultivation, and related areas, the Contractor shall take care to damage as little of the property as possible.

B. Upon completion of the construction and review and acceptance by the County, the Contractor shall restore the damaged area to the conditions existing prior to construction at no additional cost to the County. Replanting of pastures and crops shall be in strict accordance with acceptable local agricultural practices as defined by the County.

C. Should it be necessary to remove fences to facilitate construction, the Contractor shall use temporary restraining devices to prevent the ingress or egress of animals through the section of removed fence. After construction is completed, the Contractor shall restore the fence to its prior location and condition at no additional cost to the County.

3.08 PRESERVATION OF PUBLIC PROPERTY

A. The appropriate portions of Paragraphs 3.05, 3.06, and 3.07 of this Section shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements, and all other damaged areas.

END OF SECTION

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SECTION 02215
FINISH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide finish grading to all areas within the limits of construction.

B. Grade sub-soil: Cut out areas to receive stabilizing base course materials for paving and sidewalks. Place, finish grade, and compact topsoil.

1.02 PROTECTION

A. Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, pavement, and utility lines. Correct damage at no cost to 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.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

B. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. The topsoil shall be suitable for the proposed plant growth shown on the Drawings and specified. Use topsoil stockpiles on site if conforming to these requirements. If there is not sufficient topsoil available at the project site, the Contractor shall furnish additional topsoil as required to complete the Work at no additional cost to the County.

PART 3 - EXECUTION

3.01 SUB SOIL PREPARATION

A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc. Remove sub-soil that has been contaminated with petroleum products.

B. Cut out areas that are to receive stabilizing base for paving and sidewalks to subgrade elevation.

C. Bring sub soil to required levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

D. Slope grade away from building a minimum of 2-inches in 10-feet unless indicated otherwise on the Drawings.

E. Cultivate subgrade to a depth of 3-inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub-soil.

3.02 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding, and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.
   1. 6-inches for seeded areas.
   2. 4½-inches for sodded areas.
   3. 24-inches for shrub beds.
   4. 18-inches for flower beds.

B. Use topsoil in relatively dry state. Place during dry weather.

C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of subgrades.

D. Remove stones, roots, grass, weeds, debris, and other foreign material while spreading.

E. Manually spread topsoil around trees, plants, and buildings to prevent damage that may be caused by grading equipment.

F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

A. Remove surplus sub soil and topsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02220

EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Excavate, backfill, and compact as required for the construction of the utility system consisting of piping and appurtenances, and structural construction as shown on the Drawings and specified herein. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, compaction, grading, and slope protection to complete the Work. The Contractor shall be responsible for having determined to his or her satisfaction, prior to the submission of his or her bid, all underground utilities locations and appurtenances shown on the construction Drawings.

B. Definitions:
   1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material as determined by AASHTO T-180 (ASTM D155).
   2. Optimum Moisture: Percentage of water in a specific material at maximum density.
   3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
   4. Suitable: Suitable materials for fills shall be non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt, or muck. The Contractor shall furnish all additional fill material required.
   5. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.

C. Plan For Earthwork: The Contractor shall be responsible for having determined, to his or her satisfaction, prior to the submission of his or her bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the Work, the general and local conditions, and all other matters that can in any way affect the Work under this Contract. Prior to commencing the excavation, the Contractor shall submit a plan of his or her proposed operations, including maintenance of traffic, to the County for review. The Contractor shall consider, and her or his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the Work to be done will reflect all costs pertaining to the Work.

1.02 QUALITY ASSURANCE

A. Testing laboratory employed by the County will make such tests as are deemed advisable. The Contractor shall schedule work to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his or her progress. Costs for initial testing shall be paid by the County; however, tests that have to be repeated because of the failure of the tested material to meet specification shall be paid for by the Contractor and the cost of re-testing shall be deducted from payments due the Contractor.

B. Standards
   1. AASHTO: American Association of State Highway and Transportation Officials.
   2. ANSI: American National Standards Institute.
   3. ASCE: American Society of Civil Engineers.
   4. ASTM: American Society for Testing and Materials.
   5. AWWA: American Water Works Association.
   6. OSHA 29 CFR Subpart P – Excavations and Trenches a) 1926.650, 1926.651, 1926.652.
   7. OSHA 29 CFR Subpart J - a) 1910.146 for Confined Space Entry.

1.03 JOB CONDITIONS

A. Existing Utilities:
   1. The Contractor is responsible for subsurface verification of existing utilities prior to construction. Locate existing utilities in the area of work in accordance with Sunshine State One Call regulations, Chapter 556, "Underground Facility Damage Prevention and Safety Act", FS.
   2. Should uncharted or incorrectly charted piping or other utility be encountered during excavation, notify the County. Keep all facilities in operation and repair damaged utilities to the satisfaction of the County.
   3. Damage and repair costs to such piping or utilities are the Contractor's responsibility.
   4. If utilities are to remain in place, the Contractor shall provide adequate means of protection.

B. Test borings and the sub-surface exploration data if previously done on the site will be made available upon request and are for the Contractor's information only.

1.04 PROTECTION

A. Sheeting and Bracing:
   1. Requirements of the Trench Safety Act shall be adhered to at all times.

2. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement that could in any way diminish the width of the excavation below that necessary for proper construction, to protect adjacent structures and power poles from undermining, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams, or other acceptable methods. If the County is of the opinion that at any point sufficient or proper supports have not been provided, the County may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his or her responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the County.
3. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by the Contractor at his or her own expense so as to provide the necessary clearances and dimensions.
4. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and the Professional Engineer shall provide certification of this.
5. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
6. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the County may direct the Contractor in writing to leave in place at any time during the progress of the Work for the purpose of preventing damage to structures, utilities, or property, whether public or private. The County may direct that timber used for sheeting and bracing be cut off at any specified elevation.
7. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the County.
8. The County's right to order sheeting and bracing left in place shall not be construed as creating any obligation on the County's part to issue such orders, and their failure to exercise this right shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the Work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

9. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1-foot above the top of any pipe.

B. Pumping and Drainage:
   1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing the water level to return to the natural level as stipulated in Section 02140: Dewatering. The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida to design the dewatering systems. The Contractor shall submit to the County for a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and the Professional Engineer shall provide certification of this. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the Work and require such modifications as may be required to assure that the systems are performing satisfactorily.
   2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed bottom of excavation and to preserve the integrity of adjacent structures. Dewatering by trench pumping will not be permitted if migration of fine grained natural material from bottom, sidewalls, or bedding material will occur.
   3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
   4. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.
   5. Permission to use any storm sewers or drains for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. The Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and s/he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the County or the authority having jurisdiction, at no cost to the County.
   6. The Contractor shall prevent flotation by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
   7. Removal of dewatering equipment shall be accomplished after compaction/density testing has been completed and the system is no longer required. The Contractor shall remove the material and equipment constituting the system.
   8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, or other contaminates in order to prevent adverse effects on groundwater quality.

1.05 TESTING AND INSPECTION SERVICE

A. The County will provide a geotechnical testing and inspection service. The services include testing soil materials and quality control testing during filling and backfilling operations. Samples of soil materials shall be furnished to the testing service by the Contractor. The County shall pay costs of initial geotechnical testing. The Contractor shall pay for any subsequent testing required due to failure and laboratory stand-by charges incurred.

B. The Contractor shall provide monthly density testing reports to the County during backfilling activities. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractors expense.

C. Density testing scheduled subsequent to backfilling activities shall be coordinated with, and witnessed by the County. Failure by the Contractor to coordinate or have the County present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense.

D. Dewatering systems shall not be removed until compaction/density testing has been completed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   1. All fill material shall be subject to the review and acceptance of the County.
   2. All fill material shall be free of organic material, trash, or other objectionable material. The Contractor shall remove excess or unsuitable material from the job site.

B. Common Fill Material: Common fill shall consist of mineral soil, substantially free of clay, organic material, muck, loam, wood, trash, and other objectionable material which may be compressible or that cannot be compacted properly. Common fill shall not contain stones larger than 3½-inches in any dimension in the top 12-inches or 6-inches in any dimension in the balance of fill area. Common fill shall not contain asphalt, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties that allow it to be easily spread and compacted during filling. Additional common fill shall be no more than 12 % by weight finer than the No. 200 mesh sieve, unless finer material is approved for use in a specific location by the County. Select Common Fill shall be as specified as above from common fill, except that the material shall contain no stones larger than ½-inches in largest dimension and shall be no more than 5 % by weight finer than the No. 200 mesh sieve.

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

US Sieve Size	Percent Passing By Weight
No. 1	100
No. 4	75 - 100
No. 40	15 - 80
No. 100	0 - 30
No. 200	0 - 12

D. Class 1 Soils*: Manufactured angular, granular material, ¼ to 1½-inch (6 to 4 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

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

U.S. Sieve Size	% Passing By Weight
½	100
3/8	100
No. 4	20 – 25
No. 8	5 – 30
No. 16	0 - 10
No. 50	0 - 2

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

*Soils defined as Class I materials are not defined in ASTM D2487.
**In accordance with ASTM D2487, less than 5 % pass No. 200 sieve.

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

U.S. Sieve Size	Percent Passing By Weight
3/8	100
No. 10	85 – 100
No. 40	20 – 40
No. 200	0 - 12

G. Other Material: All other material, not specifically described, but required for proper completion of the Work shall be selected by the Contractor and acceptable by the County.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing:
   1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth within 10-feet of the lines of the excavation.
   2. Strip and stockpile topsoil on the site at the location to be determined by the County.

3.02 EXCAVATION

A. General: Excavations for roadways, structures, and utilities must be carefully executed in order to avoid interruption of utility service.

B. Excavating for Roadways/Structures/Utilities:
   1. Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.
      a. Excavation for precast or prefabricated structures shall be carried to an elevation 2-feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be measured by the County to verify that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.
      b. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.
      c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation.
   2. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.

3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the Work.
4. Encounters with subsurface obstructions shall be hand excavated.
5. Excavation and dewatering shall be accomplished by methods that preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone as required by the County at the Contractor's expense.
6. The bottom of excavations shall be rendered firm and dry before placing any piping or structure.
7. All pavements shall be cut with saws or approved power tools prior to removal.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.

3.03 DRAINAGE

A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.

B. All water pumped or drained from the Work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24-hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his or her failure to do so.

D. The Contractor will be required at his or her expense to excavate below grade and refill with crushed stone (gradation 57 or 89) or other acceptable fill material if the County determines that adequate dewatering has not been provided.

3.04 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, s/he shall refill to normal grade with fill at his or her own cost. Fill material and compaction method shall be approved by the County.

3.05 FILL AND COMPACTION

A. Compact and backfill excavations and construct embankment according to the following schedule. (Modified Proctor standard shall be ASTM D-1557):

STRUCTURES AND ROADWORK

Area	Material	Compaction
Beneath Structures	Structural Fill	12-inch lifts, compacted to 98% maximum density as determined by AASHTO T-180. Fill Should not be placed over any in-place soils until those deposits have been compacted to 98% Modified Proctor.
Around Structures	Structural Fill	12-inch lifts, 95% of maximum density as determined by AASHTO T-180. Rubber Tire or vibratory plate compactors shall be used
Beneath Paved Surfaces	Common Fill	12-inch lifts, 98% by maximum density as determined by AASHTO T-180 or as required by the FDOT Standards.
Open Areas	Common Fill	12-inch lifts, 95% by maximum density as determined by AASHTO T-180.

B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. The backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.

D. Embankments shall be constructed true to lines, grades, and cross sections shown on the plans or ordered by the County. Embankments shall be placed in successive layers of not more than 8-inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the Work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.

E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the County. Acceptance will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The County's acceptance shall be in writing.

F. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The County may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of the compaction tests within the trench shall be in conformance with the following schedule:
   1. At least one test at the spring line of the pipe.

2. At least one test for each 12-inch layer of backfill within the pipe bedding zone for pipes 24-inches and larger.
3. One test at an elevation of 1-foot above the top of pipe.
4. One test for each 2-feet of backfill placed from 1-foot above the top of the pipe to finished grade elevation.
5. Density testing is required for sanitary sewer manholes. Tests shall be staggered around the manhole within 3-feet of the structure's outside diameter.
   a. First test shall be 1-foot above the structure base.
   b. Second test shall be 2-feet above the first test and subsequent tests every 2-feet up the finished grade.
6. The Contractor shall provide additional compaction and testing prior to commencing further construction if the County's testing reports and inspection indicate that the fill has been placed below specified density.
7. The Contractor shall coordinate testing with the County approved testing laboratory and shall provide monthly test results to the County in a timely manner during construction activities. Density testing scheduled subsequent to backfilling activities shall be coordinated with the County and witnessed by the County representative. Failure by the Contractor to coordinate or have the County representative present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractor's expense as deemed necessary by the County's representative.
8. Dewatering systems shall not be removed until compaction/density testing has been completed.

END OF SECTION

SECTION 02573

ASPHALT PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Mill or remove existing asphalt pavement and base materials and install asphalt paving on a prepared base or as an overlay to existing asphalt pavement sections. Provide Maintenance of Traffic and coordinate and install temporary and permanent replacement of traffic signalization and 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.

B. Type S Asphalt Concrete (Type S-1 or S-3) is required. The equivalent fine Type SP (Superpave) Asphalt Concrete mixture (Traffic Level C) meeting the requirements of FDOT Specification Section 334 may be selected as an alternate at no additional cost to the County. The equivalent mixes are as follows:
   1. Type S-1: Type SP-12.5
   2. Type S-3: Type SP-9.5

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 1½-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 that 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:
   1. For pavement of a specified thickness of 2½-inches or more: ½-inch
   2. For pavement of a specified thickness less than 2½-inches: ¼-inch

E. Where the deficiency in thickness is: (1) in excess of 3/8-inch for pavement of less than 2½-inches in specified thickness, or (2) in excess of ¾-inch for pavement of specified thickness of 2½-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

SECTION 02576

CONCRETE SIDEWALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Constructing new concrete sidewalks, driveways, and curb and gutters as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Codes and Standards: Comply with applicable sections of FDOT Specifications and local governing regulations.

B. The mixture, placement, and curing of all concrete work shall be in accordance with FDOT 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. Furnish manufacturer's product data, design mixes, test reports, and materials certifications.

1.04 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities, as specified under Section 01570: Maintenance of Traffic.

B. Utilize flagman, barricades, warning signs, and warning lights as required.

1.05 GUARANTEE

A. All restored areas within the public right-of-way shall be guaranteed for 1-year after final acceptance. In the event of cracked or broken concrete surfaces, the Contractor shall make the necessary repairs to restore the concrete within 10-calendar days after notification by the County. The cost of such repairs shall be paid by the Contractor.

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 CONCRETE MATERIALS

A. Forms: Steel or wood for each type of use of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
   1. Use flexible spring steel forms or laminated boards to form radius bends as required.
   2. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.

B. Fibermesh Reinforcement: Fibermesh reinforcement fibers shall be 2-inches to 3-inches collated polypropylene fibers. Fibers shall be in strict accordance with the manufacturer recommendations and within the time as specified in ASTM C94, Type III 4.13 and applicable building codes.

C. Concrete Materials: Comply with requirements of FDOT Section 347 for concrete materials, admixtures, bonding materials, curing materials, and others as required.

D. Epoxy Resin Grout: Type N as specified in FDOT Section 926.

E. Aggregate, brick, or other material required to match existing driveway or walk shall be as approved by the County.

2.03 CONCRETE MIX, DESIGN, AND TESTING

A. Comply with requirements of applicable FDOT Section 347 for concrete mix design, sampling and testing, and quality control, and as herein specified.

B. Design the mix to produce standard weight concrete consisting of Portland cement, aggregate, air entraining admixture, and water to produce the following properties.
   1. Compressive Strength: Class B, 3,000 psi for walks and curbs.
   2. Compressive Strength: Class A, 4,000 psi for driveways.
   3. Air Content: 3% to 6% .

C. Concrete slump shall not exceed plus or minus 1-inch from approved design slump.

PART 3 - EXECUTION

3.01 CONCRETE SIDEWALK, DRIVEWAY, AND CURB AND GUTTER

A. Surface Preparation:
   1. Remove loose material from the compacted sub base surface immediately before placing concrete.
   2. Proof-roll prepared sub base surface to check for unstable areas and the need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Form Construction:
   1. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the Work and so that forms can remain in place at least 24-hours after concrete placement.
   2. Check completed form work for grade alignment to the following tolerances:
      a. Top of forms not more than 1/8-inch in 10-feet.
      b. Vertical face on longitudinal axis, not more than ¼-inch in 10-feet.
   3. Clean forms for reuse immediately after use, and coat with form release agent as often as required to ensure separation from concrete without damage.

C. Concrete Placement:
   1. Do not place concrete until sub base and forms have been checked for line and grade. Moisten if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are completed to required finish elevation and alignment. Use special colors or aggregate as required to match existing material.
   2. Place concrete using methods which prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices. Do not use vibrators to push or move concrete in forms or chute.
   3. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than ½-hour, place a construction joint.
   4. An automatic machine may be used for sidewalk or curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed the minimum herein specified. Machine placement must produce sidewalks and/or curbs and gutters to the required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

5. Joints: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of the concrete, unless otherwise indicated. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures place transverse joints to align with previously placed joints, unless otherwise indicated.
    a. Weakened-Plane Joints: Provide weakened-plane (contraction) joints sectioning concrete into areas as shown on the Drawings. Construct weakened plane joints for a depth equal to at least ¼ concrete thickness by sawing within 24-hours of placement or formed during finishing operations. Place joints at intervals not to exceed 10-feet if not otherwise indicated.
    b. Construction Joints: Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than ½-hour, except where such pours terminate at expansion joints. Construction joints shall be as shown or, if not shown, use standard metal keyway-section form of appropriate height.
    c. Expansion Joints:
        (1) Provide premolded joint filler for expansion joints abutting concrete curbs, catch basin, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.
        (2) Locate expansion joints at 12-feet on center for concrete walks unless otherwise indicated.
        (3) Extend joint fillers full-width and depth of joint, and not less than ½-inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
        (4) Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Pieces shorter than 4-inches shall not be used unless specifically shown as such.
        (5) Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
        (6) Fillers and Sealants: Comply with the requirements of these specifications for preparation of joints, materials installation, and performance, and as herein specified.

D. Concrete Finishing:
1. After striking-off and consolidating concrete, smooth the surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
2. After floating, test surface for trueness with a 20-foot straightedge. Variations exceeding 1/3-inch for any two points within 10-feet shall not be acceptable. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
3. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round 10½-inch radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.

4. After completion of floating and when excess moisture or surface sheen has disappeared, broom finish sidewalks by drawing a fine-hair broom across concrete surface, perpendicular to a line of pedestrian traffic. If the existing material has another finish, match existing finish.
5. Do not remove forms for 24-hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas.

E. Curing:

Protect and cure finished concrete paving and walks, complying with applicable requirements of FDOT Section 350. Use moist-curing methods for initial curing of approved concrete curing compounds whenever possible.

F. Repairs and Protections:
1. Repair or replace broken or defective concrete, as directed by the County.
2. Drill test cores where directed by the County, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout.
3. Protect concrete from damage until acceptance of work. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
4. Sweep concrete pavement and wash free of stains and discolorations, dirt, and other foreign material just prior to final inspection.

3.02 FIELD QUALITY CONTROL

A. General: Repair or remove and replace unacceptable concrete sidewalk, driveways, or curb and gutter as directed by the County.

B. Surface Elevation: Actual surface elevations shall be within ± 0.05 feet of specified or indicated elevations at any given point. Surface elevations between any 2 given points shall be interpolated from a direct line between the 2 points. Surfaces exceeding actual elevation tolerances of more than ± 0.05 feet at any 2 points within a distance of 15-feet will not be acceptable.

END OF SECTION

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SECTION 02578
SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Establishing a stand of grass by furnishing and placing grass sod. Included are fertilizing, watering, and maintenance as required to assure a healthy stand of grass. Solid sodding shall be placed on all slopes greater than 4:1, within 10-feet of all proposed structures, and in all areas where existing grass or sod (regardless of its condition) is removed or disturbed by Contractor's operation unless otherwise specified or shown on the Drawings.

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

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 GRASS SOD

A. Grass sod for the road rights-of-way shall be of variety to match the existing adjacent area and shall be well matted with grass roots. The sod shall be taken up in rectangles, preferably 12-inch by 24-inch, shall be a minimum of 2-inches in thickness, and shall be live, fresh, and uninjured at the time of planting.

B. Grass sod for restoration of new construction sites and/or areas disturbed by construction on existing sites shall be St. Augustine well matted with grass roots. The sod shall be taken up in rectangles, preferably 12-inch by 24-inch, shall be a minimum of 2-inches in thickness, and shall be live, fresh, and uninjured at the time of planting.

C. It shall be reasonably free of weeds and other grasses and shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.03 FERTILIZER

A. Commercial fertilizers shall comply with the state fertilizer laws.

B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid, and (3) water-soluble potash contained in the fertilizer.

C. The chemical designation of the fertilizer shall be 6-6-6. At least 50% of the nitrogen shall be derived from organic sources. At least 50 % of the phosphoric acid shall be from normal super phosphate or an equivalent source, which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

2.04 WATER FOR GRASSING

A. The water used in the sodding operations shall be by the Contractor as approved by the County.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

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

3.02 APPLICATION OF FERTILIZER

A. Before applying fertilizer, the soil pH shall be brought to a range of 6.0 – 7.0.

B. The fertilizer shall be spread uniformly over the area to be sodded at the rate of 700-pounds per acre, or 16-pounds per 1,000 square feet, by a spreading device capable of uniformly distributing the material at the specified rate. Immediately after spreading, the fertilizer shall be mixed with the soil to a depth of approximately 4-inches.

C. On steep slopes, where the use of a machine for spreading or mixing is not practicable, the fertilizer shall be spread by hand and raked in and thoroughly mixed with the soil to a depth of approximately 2-inches.

3.03 PLACING SOD

A. The sod shall be placed on the prepared surface, with edges in close contact and shall be firmly and smoothly embedded by light tamping with appropriate tools.

B. Where sodding is used in drainage ditches, or on slopes of 4:1 or greater, the setting of the pieces shall be staggered to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offsets of individual strips shall not exceed 6-inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.

C. On slopes greater than 2:1, the Contractor shall, if necessary, prevent the sod from sliding by means of wooden pegs driven through the sod blocks into firm earth at suitable intervals.

D. Sod which has been cut for more than 72-hours shall not be used unless specifically authorized by the County after the inspection thereof. Sod which is not planted within 24-hours after cutting shall be stacked in an approved manner, maintained, and properly moistened. Any pieces of sod that, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.

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

3.04 WATERING

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

3.05 MAINTENANCE

A. The Contractor shall maintain the sodded areas in a satisfactory condition, at his or her expense, until final acceptance of the Project. Such maintenance shall include repairing of any damaged areas and replacing areas in which the establishment of the grass stand does not appear to be developing satisfactorily.

B. Replanting or repair necessary due to the Contractor's negligence, carelessness, or failure to provide routine maintenance shall be at the Contractor's expense.

END OF SECTION

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DIVISION 3
CONCRETE

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and cut, remove, repair or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

B. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts and other items furnished under other Sections and required to be cast into concrete, or approved in advance by the Engineer.

1.02 RELATED WORK

A. Concrete Reinforcement is included in Section 03200.

B. Concrete Joints and Joint Accessories are included in Section 03250

C. Cast-in-Place Concrete is included in Section 03300.

D. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Form release agent

2. Form ties

B. Samples

1. Demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated or otherwise finished and will not affect the forming materials.

C. Certificates

1. Certify that form release agent is suitable for use in contact with potable water after 30 days (non-toxic and free of taste and odor).

1.04 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete

2. ACI 318 - Building Code Requirements for Reinforced Concrete

3. ACI 347 - Formwork for Concrete

B. American Plywood Association (APA)

1. Material grades and designations as specified

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 SYSTEM DESCRIPTION

A. General: Architectural Concrete is wall, slab, beam or column concrete which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water containment structures from the top of walls to 2-ft below the normal water surface in open tanks and basins.

B. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 and as recommended in ACI 347 and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete.

PART 2 - PRODUCTS

2.01 GENERAL

A. The usage of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configurations desired.

2.02 MATERIALS

A. Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved. All forms shall be designed and constructed to provide a flat, uniform concrete surface requiring minimal finishing or repairs.

B. Wall Forms

1. Forms for all exposed exterior and interior concrete walls shall be "Plyform" exterior grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group, or equal acceptable to the Engineer. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding.

2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging.

C. Rustication strips shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

D. Form Release Agent

1. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water based, bond-breaking form coating unless otherwise noted. Form release agents used in potable water containment structures shall be suitable for use in contact with potable water and shall be non-toxic and free of taste or odor and meet the requirements of NSF/ANSI Standard 61. Form release agent shall be Farm Fresh by Unitex or approved equal.

E. Form Ties

1. Form ties encased in concrete other than those specified in the following paragraphs shall be designed so that, after removal of the projecting part, no metal shall remain within 1-1/2-in of the face of the concrete. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a wood or metal cone at least 1/2-in diameter and 1-1/2-in long. Form ties in concrete exposed to view shall be the cone-washer type.

2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.

3. Flat bar ties for panel forms, if used, shall have plastic or rubber inserts having a minimum depth of 1-1/2-in and sufficient dimensions to permit proper patching of the tie hole.

4. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie.

5. Common wire shall not be used for form ties.

6. Alternate form ties consisting of tapered through-bolts at least 1-in in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain Engineer's acceptance of system and spacing of ties prior to ordering or purchase of forming. Clean, fill and seal form tie hole with non-shrink cement grout. A vinyl plug shall be inserted into the hole to serve as a waterstop. The

Contractor shall be responsible for water-tightness of the form ties and any repairs needed.

PART 3 - EXECUTION

3.01 GENERAL

A. Forms shall be used for all cast-in-place concrete including sides of footings. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions and appearance indicated on the Drawings.

B. Forms for walls shall have removable panels at the bottom for cleaning, inspection and joint surface preparation. Forms for walls of considerable height shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, to prevent segregation and to prevent the accumulation of hardened concrete on the forms above the fresh concrete.

C. Molding, bevels, or other types of chamfer strips shall be placed to produce block outs, rustications, or chamfers as shown on the Drawings or as specified herein. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a 3/4-in chamfer. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealants manufacturer's recommendations.

D. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.

E. Before form material is re-used, all surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn and all protrusions smoothed. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

3.02 FORM TOLERANCES

A. Forms shall be surfaced, designed and constructed in accordance with the recommendations of ACI 347 and shall meet the following additional requirements for the specified finishes.

1. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/16-in and forms for plane surfaces shall be such that the concrete will be plane within 3/16-in in 4-ft. Forms shall be tight to prevent the passage of mortar, water and grout. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-in from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.

2. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.

3. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1-in.

3.03 FORM PREPARATION

A. Wood forms in contact with the concrete shall be coated with an effective release agent prior to form installation.

B. Steel forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those utilized for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

3.04 REMOVAL OF FORMS

A. The Contractor shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347. Form removal shall conform to the requirements specified in Section 03300 and a curing compound applied.

3.05 INSPECTION

A. The Engineer on site shall be notified when the forms are complete and ready for inspection at least 6 hours prior to the proposed concrete placement.

B. Failure of the forms to comply with the requirements specified herein or to produce concrete complying with requirements of Section 03300 shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all concrete reinforcement complete as shown on the Drawings and as specified herein.

B. Furnish only all deformed steel reinforcement required to be entirely built into concrete masonry unit construction.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Cast-in-place Concrete is included in Section 03300.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Reinforcing steel. Placement drawings shall conform to the recommendations of ACI 315. All reinforcement in a concrete placement shall be included on a single placement drawing or cross referenced to the pertinent main placement drawing. The main drawing shall include the additional reinforcement (around openings, at corners, etc) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified. For all cast-in-place concrete tanks, retaining walls, building stem walls, wall sections shall be included in the drawings.

2. Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings.

3. Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule. The name of the manufacturer of the fibers and the product data shall be included with the submittal.

B. Submit Test Reports, in accordance with Section 01300, of each of the following items.

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.

2. Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement required.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

3. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

6. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

7. ASTM A616 - Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

8. ASTM A617 - Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

9. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

10. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

11. ASTM A775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

12. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

13. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.

B. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete

2. ACI 315 - Details and Detailing of Concrete Reinforcement.

3. ACI 318 - Building Code Requirements for Structural Concrete

4. ACI SP-66 - ACI Detailing Manual

C. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice

D. American Welding Society (AWS)

1. AWS D1.4 - Structural Welding Code Reinforcing Steel

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Provide services of a manufacturer's representative, with at least 2 years experience in the use of the reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.

1.06 DELIVERY, HANDLING AND STORAGE

A. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

B. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placing Drawings.

C. Reinforcing steel shall be stored off the ground and kept free from dirt, oil, or other injurious contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall be new, of domestic manufacture and shall comply with the following material specifications.

B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.

C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM A706.

D. Welded Steel Wire Fabric: ASTM A185. Provide in flat sheets.

E. Welded Deformed Steel Wire Fabric: ASTM A497.

F. Welded Plain Bar Mats: ASTM A704 and ASTM A615 Grade 60 plain bars.

G. Fabricated Deformed Steel Bar Mats: ASTM A184 and ASTM A615 Grade 60 deformed bars.

H. The following alternate materials are allowed:

1. ASTM A615 Grade 60 may be used for ASTM A706 provided the following requirements are satisfied:

a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3000 psi.

b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.

c. The carbon equivalency (CE) of bars shall be 0.55 or less.

I. Reinforcing Steel Accessories

1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 - Maximum Protection.

2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 - Moderate Protection.

3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks. Blocks shall have equal or greater strength than the surrounding concrete.

4. Steel Protected Bar Supports: #4 Steel Chairs with plastic or rubber tips.

J. Tie Wire

1. Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire or stranded wire.

K. Mechanical reinforcing steel butt splices shall be positive connecting taper threaded type employing a hexagonal coupler such as Lenton rebar splices as manufactured by Erico Products Inc., Solon, OH or equal. They shall meet all ACI 318 Building Code requirements. Bar ends must be taper threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement. Bar couplers shall be torqued to manufacturer's recommended value.

1. Unless otherwise noted on the Drawings, mechanical tension splices shall be designed to produce a splice strength in tension or compression of not less than 125 percent of the ASTM specified minimum yield strength of the rebar.

2. Compression type mechanical splices shall provide concentric bearing from one bar to the other bar and shall be capable of developing the ultimate strength of the rebar in compression.

L. Fiber Reinforcement

1. Synthetic reinforcing fiber for concrete shall be 100 percent polypropylene collated, fibrillated fibers as manufactured by Propex Concrete Systems Chattanooga, TN - Propex or equal. Fiber length and quantity for the concrete mix shall be in strict compliance with the manufacturer's recommendations as approved by the Engineer.

2.02 FABRICATION

A. Fabrication of reinforcement shall be in compliance with the CRSI Manual of Standard Practice.

B. Bars shall be cold bent. Bars shall not be straightened or rebent.

C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the ACI 318.

D. Bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded, shall have the applicable end(s) saw-cut. Such ends shall terminate in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Surface condition, bending, spacing and tolerances of placement of reinforcement shall comply with the CRSI Manual of Standard Practice. The Contractor shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.

B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:

1. Concrete cast against and permanently exposed to earth: 3-in

2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2-in (Including bottom cover of slabs over water or sewage)

3. Concrete not exposed to soil, water, sewage, sludge and/or weather:

a. Slabs (top and bottom cover), walls, joists, shells and folded plate members – 3/4-in

b. Beams and columns (principal reinforcement, ties, spirals and stirrups) - 1-1/2-in

C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.

D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified herein, or unless prior written approval has been obtained from the Engineer. All bars that have been welded,

including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.

E. Reinforcing steel interfering with the location of other reinforcing steel, conduits or embedded items, may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the Engineer.

F. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.

G. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the Engineer. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld or otherwise repair as directed by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

3.02 REINFORCEMENT AROUND OPENINGS

A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.03 SPLICING OF REINFORCEMENT

A. Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30 bar diameters, but not less than 12-in. The lap splice length for column vertical bars shall be based on the bar size in the column above.

B. Tension lap splices shall be provided at all laps in compliance with ACI 318. Splices in adjacent bars shall be staggered. Class A splices may be used when 50 percent or less of the bars are spliced within the required lap length. Class B splices shall be used at all other locations.

C. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125 percent of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class B splice.

D. Install wire fabric in as long lengths as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI-318 but not less than 12-in. The spliced

fabrics shall be tied together with wire ties spaced not more than 24-in on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.

E. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings. Splices in adjacent bars shall be offset by at least 30 bar diameters. Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the Engineer.

3.04 ACCESSORIES

A. Determine, provide and install accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.

B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.

C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified herein.

D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

3.05 INSPECTION

A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been observed by the Engineer and the Engineer's release to proceed with the concreting has been obtained. The Engineer shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his/her observations of the reinforcing steel.

END OF SECTION

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SECTION 03250

CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Cast-In-Place Concrete is included in Section 03300.

D. Concrete Finishes are included in Section 03350.

E. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data. Submittals shall include at least the following:

1. Standard Waterstops: Product data including catalogue cut, technical data, storage requirements, splicing methods and conformity to ASTM standards.

2. Special Waterstops: Product data including catalogue cut, technical data, location of use, storage requirements, splicing methods, installation instructions and conformity to ASTM standards.

3. Premolded joint fillers: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

4. Bond breaker: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

5. Expansion joint dowels: Product data on the complete assembly including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements and conformity to ASTM standards.

6. Compressible joint filler: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

7. Bonding agents: Product data including catalogue cut, technical data, storage requirements, product life, application requirements and conformity to ASTM standards.

B. Certifications

1. Certification that all materials used within the joint system is compatible with each other.

2. Certifications that materials used in the construction of joints are suitable for use in contact with potable water 30 days after installation.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

2. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

3. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

4. ASTM D1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types).

5. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. U.S. Army Corps of Engineers (CRD).

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

C. Federal Specifications

1. FS SS-S-210A - Sealing Compound for Expansion Joints.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc) shall be compatible with one another. Coordinate selection of suppliers

and products to ensure compatibility. Under no circumstances shall asphaltic bond breakers or joint fillers be used in joints receiving sealant.

C. All chemical sealant type waterstops shall be products specifically manufactured for the purpose for which they will be used and the products shall have been successfully used on similar structures for more than five years.

2.02 MATERIALS

A. Standard Waterstops

1. PVC Waterstops - The waterstop shall be made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of waterstop shall be 1750 psi. The waterstop shall conform to CRD-C572. The waterstop shall be Greenstreak Group, Inc. model No. 679 or approved equal for construction joints. The waterstop shall be Greenstreak Group Inc. model No.732 or approved equal for control joints and Greenstreak Group Inc. Model No. 738 for expansion joints. Provide grommets or pre-punched holes spaced at 12 inches on center along length of waterstop.

2. Factory Fabrications: Provide factory made waterstop fabrications for all changes of direction, transitions, and intersections, leaving only straight butt joints of sufficient length for splicing in the field.

B. Special Waterstops

1. Base Seal PVC Waterstop - The waterstop shall be made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of waterstop shall be 1750 psi. The waterstop shall conform to CRD-C572. Waterstops shall be style 925 for expansion joints, style 928 for control joints, and style 927 for construction joints by Greenstreak Plastic Products, St. Louis, MO or equal.

2. Preformed adhesive waterstops - The waterstop shall be a rope type preformed plastic waterstop meeting the requirements of Federal Specification SS-S-210A. The rope shall have a cross-section of approximately one square inch unless otherwise specified or shown on the Drawings. The waterstop shall be Synko-Flex waterstop as manufactured by Synko-Flex Products of Houston, TX, Lockstop by Greenstreak Group Inc., or equal. Primer for the material shall be as recommended by the waterstop manufacturer.

C. Premolded Joint Filler

1. Premolded joint filler - Structures. Self-expanding cork, premolded joint filler shall conform to ASTM D1752, Type III. The thickness shall be 3/4-in unless shown otherwise on the Drawings.

2. Premolded joint filler - sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings. The joint filler shall be

asphalt-impregnated fiber board conforming to ASTM D1751. Thickness shall be 3/4-in unless otherwise shown on the Drawings.

D. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.

2. Except where tape is specifically called for on the drawings, bond breaker for concrete shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors Inc.; Silcoseal 77, by SCA Construction Supply Division, Superior Concrete Accessories or equal.

E. Expansion Joint Dowels

1. Dowels shall be smooth steel conforming to ASTM A675, Grade 70. Dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04-in on the diameter of the dowel and extends no more than 0.04-in from the end. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end. Caps shall allow for at least 1-1/2-in of expansion.

2. Dowel Bar Sleeves: Provide Greenstreak two component Speed Dowel System, to accept 1” diameter x 12” long slip dowels. The Greenstreak Group, Inc. Speed Dowel System is comprised of a reusable base and a plastic sleeve. Both pieces shall be manufactured from polypropylene plastic.

F. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881, Type II. The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of Lyndhurst, N.J.; Concresive Liquid (LPL) by Master Builders of Cleveland, OH or equal. Acrylic may be used if approved by the Engineer.

G. Compressible Joint Filler

1. The joint filler shall be a non-extruded watertight strip material use to fill expansion joints between structures. The material shall be capable of being compressed at least 40 percent for 70 hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in the first 1/2 hour after unloading. Compressible Joint filler shall be Evasote 380 E.S.P, by E-Poxy Industries, Inc., Ravena, NY , Sikaflex 1a by Sika or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Standard Waterstops

1. Install waterstops for all joints where indicated on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided. Provide factory made waterstop fabrications for all changes in direction, intersections and transitions leaving only straight butt joints splices for the field.

2. Horizontal waterstops in slabs shall be clamped in position by the bulkhead (unless previously set in concrete).

3. Waterstops shall be installed so that half of the width will be embedded on each side of the joint. Care shall be exercised to ensure that the waterstop is completely embedded in void-free concrete.

4. Waterstops shall be terminated 3-in below the exposed top of walls. Expansion joint waterstop center bulbs shall be plugged with foam rubber, 1-in deep, at point of termination.

B. Special Waterstops

1. Install special waterstops at joints where specifically noted on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided. Provide factory made waterstop fabrications for all changes in direction, intersections and transitions leaving only straight butt joints splices for the field.

2. Each piece of the waterstop shall be of maximum practicable length to provide a minimum number of connections or splices. Connections and splices shall conform to the manufacturer's recommendations and as specified herein.

3. Waterstops shall be terminated 3-in below the exposed top of walls.

C. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor, must be submitted to the Engineer for written approval.

2. Additional or relocated joints should be located where they least impair strength of the member. In general, locate joints within the middle third of spans of slabs, beams and girders. However, if a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.

3. All joints shall be perpendicular to main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. When joints in beams are allowed, provide a shear key and inclined dowels as approved by the Engineer.

4. Provide sealant grooves for joint sealant where indicated on the Drawings.

5. At all construction joints and at concrete joints designated on the Drawings to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points or side to side) of approximately 1/4-in to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by water-blasting or sandblasting and prepare for bonding.

6. Provide waterstops in all wall and slab construction joints in liquid containment structures and at other locations shown on the Drawings.

7. Keyways shall not be used in construction joints unless specifically shown on the Drawings or approved by the Engineer.

D. Expansion Joints

1. Do not extend through expansion joints, reinforcement or other embedded metal items that are continuously bonded to concrete on each side of joint.

2. Position premolded joint filler material accurately. Secure the joint filler against displacement during concrete placement and compaction. Place joint filler over the face of the joint, allowing for sealant grooves as detailed on the Drawings. Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as shown on the Drawings.

3. Expansion joints shall be 3/4-in in width unless otherwise noted on the Drawings.

4. Where indicated on Drawings, install smooth dowels at right angles to expansion joints. Align dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the Drawings, apply oil or grease to one end of all dowels through expansion joints. Provide plastic expansion caps on the lubricated ends of expansion dowels.

5. Provide center bulb type waterstops in all wall and slab expansion joints in liquid containment structures and at other locations shown on the Drawings.

E. Control Joints

1. Provide sealant grooves, sealants and waterstops at control joints in slabs on grade or walls as detailed. Provide waterstops at all wall and slab control joints in water containment structures and at other locations shown on the Drawings.

2. Control joints may be sawed if specifically approved by the Engineer. If control joint grooves are sawed, properly time the saw cutting with the time of the concrete set. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses have developed sufficiently to induce cracking. No reinforcing shall be cut during sawcutting.

3. Extend every other bar of reinforcing steel through control joints or as indicated on the Drawings. Where specifically noted on the Drawings, coat the concrete surface with a bond breaker prior to placing new concrete against it. Avoid coating reinforcement or waterstops with bond breaker at these locations.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joints and Joint Accessories are included in Section 03250.

D. Concrete Finishes are included in Section 03350.

E. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data including the following:

1. Sources of cement, pozzolan and aggregates.

2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.

3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

4. Water-reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

5. High-range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type and manufacturer of cement. Provide either a. or b. below for each mix proposed.

a. Standard deviation data for each proposed concrete mix based on statistical records.

b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28 day cylinder strength test results for each mix. Provide results of 7 and 14 day tests if available.

7. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.

8. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM standards. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Test Reports

1. Fine aggregates - sieve analysis, physical properties, and deleterious substance.

2. Coarse aggregates - sieve analysis, physical properties, and deleterious substances.

3. Cements - chemical analysis and physical properties for each type.

4. Pozzolans - chemical analysis and physical properties.

5. Proposed concrete mixes - compressive strength, slump and air content.

D. Certifications

1. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

2. Certify admixtures are suitable for use in contact with potable water after 30 days of concrete curing.

3. Certify curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete

7. ASTM C150 - Standard Specification for Portland Cement

8. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete

9. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

10. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

12. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

13. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

14. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

15. ASTM C1017 - Standard Specification for Chemical Admixtures for use in Producing Flowing Concrete.

B. American Concrete Institute (ACI).

1. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.

2. ACI 305 - Hot Weather Concreting.

3. ACI 306.1 - Standard Specification for Cold Weather Concreting.

4. ACI 318 - Building Code Requirements for Structural Concrete.

5. ACI 350 - Environmental Engineering Concrete Structures.

6. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Reinforced concrete shall comply with ACI 318, the recommendations of ACI 350R and other stated requirements, codes and standards. The most stringent requirement of the codes, standards and this Section shall apply when conflicts exist.

B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.

C. Well in advance of placing concrete, discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops and curing. Propose methods of hot and cold weather concreting as required. Prior to the placement of any concrete containing a high-range water-reducing admixture (plasticizer), the Contractor, accompanied by the plasticizer manufacturer, shall discuss the properties and techniques of batching and placing plasticized concrete.

D. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at the Contractor's expense.

E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at his/her expense, make new acceptance tests of aggregates and establish new design mixes.

F. Testing of the following materials shall be furnished by Contractor to verify conformity with this Specification Section and the stated ASTM Standards.

1. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

2. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

3. Cements for conformity with ASTM C150 - chemical analysis and physical properties.

4. Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.

5. Proposed concrete mix designs - compressive strength, slump and air content.

G. Field testing and inspection services will be provided by the Owner. The cost of such work, except as specifically stated otherwise, shall be paid by the Owner. Testing of the following items shall be by the Owner to verify conformity with this Specification Section.

1. Concrete placements - compressive strength (cylinders), compressive strength (cores), slump, and air content.

2. Other materials or products that may come under question.

H. All materials incorporated in the work shall conform to accepted samples.

1.06 DELIVERY, STORAGE AND HANDLING

A. Cement: Store in weather-tight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.

B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3-ft in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to uniform moisture content before using. Do not use frozen or partially frozen aggregates.

D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

E. Pozzolan: Store in weather-tight buildings, bins or silos to provide protection from dampness and contamination.

F. Sheet Curing Materials: Store in weather-tight buildings or off the ground and under cover.

G. Liquid Curing Compounds: Store in closed containers.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Cement: U.S. made portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the Engineer and one brand shall be used throughout the Work. The following cement type(s) shall be used:

2.02 MATERIALS

A. Materials shall comply with this Section and any applicable State or local requirements.

B. Cement: Domestic portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the Engineer

and one brand shall be used throughout the Work. The following cement type(s) shall be used:

1. Class A,B,C,D Concrete - Type II with the addition of fly ash resulting in C_3A being below 5 percent of total cementitious content, Type III limited to 5 percent C_3A or Type V.

C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.

D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 1 herein.

E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.

F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix including other admixtures and shall be suitable for use in contact with potable water after 30 days of concrete curing.

1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

3. High-Range Water-Reducer (Plasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with manufacturer's recommendations. Where walls are 14” thick or less and the wall height exceeds 12 ft a mix including a plasticizer must be used.

4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water reducing or high range water reducing admixtures.

G. Pozzolan (Fly Ash): Pozzolan shall be Class C or Class F fly ash complying with ASTM C618 except the Loss on Ignition (LOI) shall be limited to 3 percent maximum.

H. Sheet Curing Materials. Waterproof paper, polyethylene film or white burlap-polyethylene sheeting all complying with ASTM C171.

I. Liquid Curing Compound. Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compound shall be approved for use in contact with potable water after 30 days (non-toxic and free of taste or odor). Curing compound shall comply with Federal, State and local VOC limits.

2.03 MIXES

A. Development of mix designs and testing shall be by an independent testing laboratory acceptable to the Engineer engaged by and at the expense of the Contractor.

B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.

C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data is not available, be developed by a testing laboratory, acceptable to the Engineer, engaged by and at the expense of the Contractor. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318. The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16 percent greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.

D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the above paragraph.

E. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.

1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.

F. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1. If a high-range water-reducer (plasticizer) is used, the slump indicated shall be that

measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.

G. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 1

CONCRETE MIX REQUIREMENTS

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Cementitious Content (4)
A	2500	C150 Type II	C33	57	440 min.
B	3000	C150 Type II	C33	57	480 min.
C	4000	C150 Type II	C33	57	560 min.
D	5000	C150 Type II	C33	57	600 min.

Class	W/Cm Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range Inches
A	0.62 max.	--	3.5 to 5	Yes	*	1-4
B	0.54 max.	--	3.5 to 5	Yes	*	1-3
C	0.44 max.	25% max	3.5 to 5	Yes	*	3-5
D	0.40 max.	--	3.5 to 5	Yes	*	3-5

NOTES:
(1) Minimum compressive strength in psi at 28 days
(2) ASTM designation
(3) Size Number in ASTM C33
(4) Cementitious content in lbs/cu yd
(5) W/Cm is Water-Cementitious ratio by weight
(6) AE is percent air-entrainment
(7) WR is water-reducer admixture
(8) HRWR is high-range water-reducer admixture

* HRWR used at contractor's option except where walls are 14" thick or less and the wall height exceeds 12 ft a mix including a plasticizer must be used.

PART 3 - EXECUTION

3.01 MEASURING MATERIALS

A. Concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.

B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Scales shall have been certified by the local Sealer of Weights and Measures within 1 year of use.

C. Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.

D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.

1. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.

2. Inject multiple admixtures separately during the batching sequence.

3.02 MIXING AND TRANSPORTING

A. Batch plants shall have a current NRMCA Certification or equal.

B. Concrete shall be ready-mixed concrete produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.

C. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.

D. Keep the water tank valve on each transit truck locked at all times. Any addition of water above the appropriate W/Cm ratio must be directed by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

E. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.

F. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.

G. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.

H. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

I. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.

J. Temperature and Mixing Time Control

1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40 degrees F.

2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.

3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.

4. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the values shown in Table 2.

TABLE 2

MAXIMUM TIME TO DISCHARGE OF CONCRETE

Air or Concrete Temperature (whichever is higher)	Maximum Time
80 to 90 Degree F (27 to 32 Degree C)	45 minutes
70 to 79 Degree F (21 to 26 Degree C)	60 minutes
40 to 69 Degree F (5 to 20 Degree C)	90 minutes

If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

3.03 CONCRETE APPEARANCE

A. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:

1. The gradation of aggregate.

2. The proportion of fine and coarse aggregate.

3. The percentage of entrained air, within the allowable limits.

B. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10-ft away, shall be pleasing in appearance, and at 20-ft shall show no visible defects.

3.04 PLACING AND COMPACTING

A. Placing

1. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can assure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.

3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.

4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.

5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.

6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.

7. Slabs

   a. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.

   b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

   c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

   a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottom of tremie tubes shall preferably be in contact with

the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12 to 24-in lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7-ft and the maximum free fall of concrete shall not exceed 15-ft.

9. Underwater concreting shall be performed in conformity with the recommendations of ACI 304R. The tremie system shall be used to place underwater concrete. Tremie pipes shall be in the range of 8 to 12-in in diameter and be spaced at not more than 16-ft on centers nor more than 8-ft from an end form. Where concrete is being placed around a pipe, there shall be at least one tremie pipe on each side of each pipe. Where the tremie system is not practical, direct pumped concrete for underwater placement may be used subject to approval of the system including details by the Engineer.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading, etc, shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.

2. All concrete shall be placed and compacted with mechanical vibrators. The number, type and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.

3. A minimum frequency of 7000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30-in apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8-in thick shall be consolidated with vibrating screeds; slabs 8 to 12-in thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.

5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. The vibrators shall be inserted vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:

a. Frequency returns to normal.

b. Surface appears liquefied, flattened and glistening.

c. Trapped air ceases to rise.

d. Coarse aggregate has blended into surface, but has not disappeared.

3.05 CURING AND PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Curing Methods

1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:

a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.

b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.

c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.

2. Specified applications of curing methods.

a. Slabs for Water Containment Structures: Water curing only.

b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.

c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.

d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.

e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.

f. Surfaces of Concrete Joints: Water cured or sheet material cured.

C. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

D. Cold Weather Concreting:

1. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.

2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified herein. Temperatures at the concrete placement shall be recorded at 12 hour intervals (minimum).

3. Discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.

4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.

a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (eg: 5 days at an average 70 degrees F = 350 degree-days).

b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.

5. Salt, manure or other chemicals shall not be used for protection.

6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

E. Hot Weather Concreting

1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr).

2. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R and the additional requirements specified herein.

   a. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.

   b. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the job and to provide vibration immediately after placement.

   c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.

3. Discuss with the Engineer a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

3.06 REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 30 percent of its specified design strength, nor before reaching the following number of day-degrees of curing (whichever is the longer):

TABLE 3

MINIMUM TIME TO FORM REMOVAL

Forms for	Degree Days
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of degree-days in Paragraph 3.05D above).

B. Shores shall not be removed until the concrete has attained at least 70 percent of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

3.07 INSPECTION AND FIELD TESTING

A. The batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing steel and the alignment, cleanliness and tightness of formwork. No placement shall be made without the inspection and acceptance of the Engineer.

B. Sets of field control cylinder specimens will be taken by the Engineer (or inspector) during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls.

1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low.

2. When the average 28 day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7 day strengths (where proper relation between seven and 28 day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.

C. Cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations and furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner. Curing boxes shall be acceptable to the Engineer.

D. Slump tests will be made in the field immediately prior to placing the concrete. Such tests shall be made in accordance with ASTM C143. If the slump is greater the specified range, the concrete shall be rejected.

E. Air Content: Test for air content shall be made on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173.

F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.

G. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

H. See Specification Section 03900 for Leak Testing.

3.08 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.

B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.

C. Should the strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

3.09 PATCHING AND REPAIRS

A. It is the intent of this Section to require quality work including adequate forming, proper mixture and placement of concrete and curing so completed concrete surfaces will require no patching.

B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified by the Engineer.

C. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.

D. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100. Promptly fill holes upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

E. When patching exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.10 SCHEDULE

A. The following (Table 4) are the general applications for the various concrete classes and design strengths:

TABLE 4

CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	2,500	Concrete fill and duct encasement

B	3,000	Concrete overlay slabs and pavements
C	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams and all other structural concrete
D	5,000	Prestressed concrete

END OF SECTION

SECTION 03350

CONCRETE FINISHES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and finish cast-in-place concrete surfaces as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Cast-In-Place Concrete is included in Section 03300.

C. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Concrete sealer. Confirmation that the sealer is compatible with additionally applied coatings shall also be submitted.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 - Standard Specification for Concrete Aggregates.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Finishes

1. For concrete which will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.

2. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for approval.

3. Services of Manufacturer's Representative

a. Make available at no extra cost to the Owner, upon 72 hours notification, the services of a qualified field representative of the manufacturer of curing compound, sealer or hardener to instruct the user on the proper application of the product under prevailing job conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Chemical hardener shall be Lapidolith by Sonneborn; Hornolith by A.C. Horn; Penalith by W.R. Meadows or equal fluosilicate base material.

B. Concrete sealer shall be "Kure-N-Seal", by Sonneborn, Minneapolis, MN or equal.

PART 3 - EXECUTION

3.01 FORMED SURFACES

A. Forms shall not be removed before the requirements of Section 03300, have been satisfied.

B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or performing any other work adjacent thereto.

C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

D. Rough-Form Finish

1. Immediately after stripping forms and before concrete has changed color, carefully remove all fins and projections.

2. Promptly fill holes left by tie cones and defects as specified in Section 03300.

E. Rubbed Finish

1. Immediately upon stripping forms and before concrete has changed color, carefully remove all fins. While the wall is still damp apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within all pits, air holes or blemishes in the parent concrete. Avoid coating large areas with the slurry at one time.

2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout proportioned by volume and consisting of 1 part cement to 1-1/2 parts of clean masonry sand having a fineness modulus of approximately 2.3 and complying with the gradation requirements of ASTM C33 for such a material. Grout shall be uniformly applied by means of damp pads of coarse burlap approximately 6-in square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in all imperfections.

3. Allow the mortar to partially harden for 1 or 2 hours depending upon the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout in the small pits or holes, cut off all that can be removed with a trowel. (Note: Grout allowed to remain on the wall too long will harden and will be difficult to remove.)

4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cutoff with the trowel so it can be wiped off clean with the burlap.

5. On the day following the repair of pits, air holes and blemishes, the walls shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.

6. A thorough wash-down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

F. Abrasive Blast Finish

1. Coordinate with Rubbed Finish application. Do not begin until Rubbed Finish operation is complete or before concrete has reached minimum 7-day strength. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality. Apply the abrasive blast finish only where indicated on Drawings.

2. Prepare a sample area of minimum 4-ft high by 16-ft wide Blast Finish as directed by Engineer on a portion of new wall construction which will not be exposed in the final work. Sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials and blasting techniques for selection by Engineer. Final accepted sample shall remain exposed until completion of all Blast Finish operations.

3. Blast finish operation shall meet all regulatory agency requirements. Blast Finish contractor shall be responsible for obtaining all required permits and/or licenses.

4. Perform abrasive blast finishing in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.

5. Use an abrasive grit of proper type and gradation as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:

   a. Medium: Generally expose coarse aggregate - 1/4-in to 3/8-in reveal.

6. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure and blasting techniques required to match Architect's samples.

7. Upon completion of the Blast Finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit. Allow to air dry until curing of concrete is complete.

8. After the concrete has cured for a minimum of 28 days, apply a clear acrylic sealer as directed by manufacturer.

3.02 FLOORS AND SLABS

A. Floated Finish

1. Machine Floating

   a. Screed floors and slabs with straightedges to the established grades shown on the Drawings. Immediately after final screeding, a dry cement/sand shake in the proportion of two sacks of portland cement to 350 lbs of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 lbs /1,000 sq ft of floor. Do not sprinkle neat, dry cement on the surface.

   b. The application of the cement/sand shake may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity and the need is not indicated. When the concrete has hardened sufficiently to support the weight of a power float without its digging into or disrupting the level surface, thoroughly float the shake into the surface with a heavy revolving disc type power compacting machine capable of providing a 200 lb compaction force distributed over a 24-in diameter disc.

   c. Start floating along walls and around columns and then move systematically across the surface leaving a matte finish.

   d. The compacting machine shall be the "Kelly Power Float with Compaction Control" as manufactured by Kelley Industries of SSP Construction Equipment Inc., Pomona, CA or equal. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. Floating with a troweling

machine equipped with normal trowel blades will not be permitted. The use of any floating or troweling machine which has a water attachment for wetting the concrete surface during finishing will not be permitted.

2. Hand Floating

a. In lieu of power floating, small areas may be compacted by hand floating. The dry cement/sand shake previously specified shall be used unless specifically eliminated by the Engineer. Screed the floors and slabs with straightedges to the established grades shown on the Drawings. While the concrete is still green, but sufficiently hardened to support a finisher and kneeboards with no more than 1/4-in indentation, wood float to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the wood floats to bring moisture to the surface.

3. Finishing Tolerances

a. Level floors and slabs to a tolerance of plus or minus 1/8-in when checked with a 10-ft straightedge placed anywhere on the slab in any direction. Where drains occur, pitch floors to drains such that there are no low spots left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish

1. Screed slabs with straightedges to the established grades indicated on the Drawings. When the concrete has stiffened sufficiently to maintain small surface indentations, draw a stiff bristle broom lightly across the surface in the direction of drainage, or, in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

C. Steel Trowel Finish

1. Finish concrete as specified in Paragraph 3.04 and 3.05. Then, hand steel trowel to a perfectly smooth hard even finish free from high or low spots or other defects.

D. Concrete Sealer

1. Prepare and seal surfaces indicated on the room finish schedule to receive a sealer as follows:

a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule in Paragraph 3.05 below.

b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application-ready when it is damp but not wet and can no longer be marred by walking workmen.

c. Newly-Cured Bare Concrete: Level any spots gouged out by trades. Remove all dirt, dust, droppage, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry so that surface is no more than damp, and not wet.

d. Aged Concrete: Restore surface soundness by patching, grouting, filling cracks and holes, etc. Surface must also be free of any dust, dirt and other foreign matter. Use power tools and/or strippers to remove any incompatible sealers or coatings. Cleanse as required, following the procedure indicated under cured concrete.

e. Methods: Apply sealer so as to form a continuous, uniform film by spray, soft-bristle pushbroom, long-nap roller or lambswool applicator. Ordinary garden-type sprayers, using neoprene hose, are recommended for best results.

f. Applications: For curing only, apply first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 sq ft per gallon. Apply second coat when all trades are completed and structure is ready for occupancy at the rate of 400 to 600 sq ft per gallon.

g. To meet guarantee and to seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full-strength. On aged concrete, when renovating, dustproofing and sealing, the first coat should be thinned 10 to 15 percent with reducer per manufacturer's directions.

3.03 CONCRETE RECEIVING CHEMICAL HARDENER

A. After 28 days, minimum, concrete cure, apply chemical hardener in three applications to a minimum total coverage of the undiluted chemical of 100 sq ft per gallon and in accordance with manufacturer's recommendations as reviewed.

3.04 APPROVAL OF FINISHES

A. All concrete surfaces, when finished, will be inspected by the Engineer.

B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked.

C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 03300 unless otherwise directed by the Engineer.

3.05 SCHEDULE OF FINISHES

A. Concrete shall be finished as specified either to remain as natural concrete to receive an additional applied finish or material under another section.

B. Concrete for the following conditions shall be finished as noted on the Drawings and as further specified herein:

1. Concrete to Receive Dampproofing: Rough-form finish. See Paragraph 3.01D above.

2. Concrete Not Exposed to View and Not Scheduled to Receive an Additional Applied Finish or Material: Rough-form finish. See Paragraph 3.01D above.

3. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed finish. See Paragraph 3.01E above.

4. Interior Vertical Concrete Exposed to View Except in Water Containment Areas: Rubbed finish. See Paragraph 3.01E above.

5. Vertical Concrete in Water Containment Areas. Rubbed finish on exposed surfaces and extending to two feet below normal operating water level: Rough-form finish on remainder of submerged areas. See Paragraphs 3.01E and 3.01D above.

6. Interior and Exterior Underside of Concrete Exposed to View: Rubbed finish. See Paragraph 3.01E above.

7. Exterior surfaces exposed to view and indicated to have an abrasive blast finish. See Paragraph 3.01F above.

8. Interior or Exterior Horizontal Concrete not Requiring Floor Hardener or Sealer: Floated finish. See Paragraph 3.02A above.

9. Concrete for Exterior Walks, Interior and Exterior Stairs: Broomed finish perpendicular to direction of traffic. See Paragraph 3.02B above.

10. Concrete Slabs On Which Process Liquids Flow or In Contact with Sludge: Steel trowel finish. See Paragraph 3.02C above.

11. Concrete to Receive Hardener: See Paragraph 3.03 above.

12. Concrete to Receive Floor Sealer: See Paragraph 3.02D above.

13. Concrete tank bottoms to be covered with grout: See Section 03600.

END OF SECTION

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SECTION 03600

GROUT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install grout complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joints and Joint Accessories are included in Section 03350.

D. Cast-in-Place Concrete is included in Section 03300.

E. Masonry Grout is included in Section 04230.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Commercially manufactured nonshrink cementitous grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.

4. Concrete grout. The submittal shall include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated in Section 03200. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.

B. Laboratory Test Reports

1. Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.

C. Certifications

1. Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.

D. Qualifications

1. Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which they will supply.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

2. ASTM C579 - Standard Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

3. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

4. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

B. U.S. Army Corps of Engineers Standard (CRD)

1. CRD C-621 - Corps of Engineers Specification for Nonshrink Grout

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

B. Pre-installation Conference

1. Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days prior to its scheduled date.

C. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required, to correct installation problems.

D. Field Testing

1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc, for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.

2. The field testing of Concrete Grout shall be as specified for concrete in Section 03300.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.

B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

1.07 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.

B. Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.

a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp. or equal.

b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp. or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy-based grout shall be a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30×10^{-6} when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co. or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 03300 except as specified herein. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 2900 psi at 28 days, or 2500 psi nominal strength. Coarse aggregate size shall be 1/2-in maximum. Slump should not

exceed 5-in and should be as low as practical yet still retain sufficient workability.

2. Synthetic reinforcing fibers as specified in Section 03200 shall be added to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 - EXECUTION

3.01 PREPARATION

A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.

B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may effect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to a minimum of ¼" amplitude or provide a raked finish in order to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.

1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION – GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.

F. Reflect all existing underlying expansion, control and construction joints through the grout.

3.03 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water

required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3-in in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION - NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION - CONCRETE GROUT

A. Screed underlying concrete to the grade shown on the Drawings. Prepare the surface according to 3.01B. Protect and keep the surface clean until placement of concrete grout.

B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing of debris into tank drain lines will not be permitted.

C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout. Saturation may be maintained by ponding, by the use or soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste. (A bonding grout composed of 1 part portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.)

D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.

E. Provide grout control joints as indicated on the Drawings.

F. Finish and cure the concrete grout as specified for cast-in-place concrete.

3.06 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

B. General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.

C. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout..

D. Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.

E. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.

F. Concrete grout: Use for overlaying the base concrete under scraper mechanisms of clarifiers to allow more control in placing the surface grade.

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SECTION 03740

MODIFICATIONS AND REPAIR TO CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and cut, remove, repair or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joints and Accessories are included in Section 03250.

D. Cast-in-Place Concrete is included in Section 03300.

E. Concrete Finishes are included in Section 03350.

F. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, a schedule of Demolition and the detailed methods of demolition to be used at each location.

B. Submit manufacturer's technical literature on all product brands proposed for use, to the Engineer for review. The submittal shall include the manufacturer's installation and/or application instructions.

C. When substitutions for acceptable brands of materials specified herein are proposed, submit brochures and technical data of the proposed substitutions to the Engineer for approval before delivery to the project.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

2. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.

3. ASTM C883 - Standard Test Method for Effective Shrinkage of Epoxy-Resin Systems Used with Concrete.

4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

6. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

7. ASTM D732 - Standard Test Method for Shear Strength of Plastics by Punch Tool.

8. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until authorization is given by the Engineer.

B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring and bracing and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust and to prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown or specified, line drilling will be required in cutting existing concrete.

C. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years experience in the manufacture of such products and shall have an ongoing program of training, certifying and technically supporting the Contractor's personnel.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Materials shall comply with this Section and any state or local regulations.

B. Epoxy Bonding Agent

1. General

    a. The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type II and the additional requirements specified herein.

2. Material

    a. Properties of the cured material:

        i. Compressive Strength (ASTM D695): 8500 psi minimum at 28 days.

        ii. Tensile Strength (ASTM D638): 4000 psi minimum at 14 days.

        iii. Flexural Strength (ASTM D790 - Modulus of Rupture): 6,300 psi minimum at 14 days.

        iv. Shear Strength (ASTM D732): 5000 psi minimum at 14 days.

        v. Water Absorption (ASTM D570 - 2 hour boil): One percent maximum at 14 days.

        vi. Bond Strength (ASTM C882) Hardened to Plastic: 1500 psi minimum at 14 days moist cure.

        vii. Effective Shrinkage (ASTM C883): Passes Test.

        viii. Color: Gray.

3. Approved manufacturers include: Sika Corporation, Lyndhurst, NJ - Sikadur 32, Hi-Mod; Master Builder's, Cleveland, OH - Concresive Liquid (LPL) or equal.

C. Epoxy Paste

1. General

    a. Epoxy Paste shall be a two-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete and shall comply with the requirements of ASTM C881, Type I, Grade 3 and the additional requirements specified herein. It may also be used to patch existing surfaces where the glue line is 1/8-in or less.

2. Material

    a. Properties of the cured material:

i. Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.

ii. Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at Break - 0.3 percent minimum.

iii. Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at 14 days.

iv. Shear Strength (ASTM D732): 2,800 psi minimum at 14 days.

v. Water Absorption (ASTM D570): 1.0 percent maximum at 7 days.

vi. Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure.

vii. Color: Concrete grey.

3. Approved manufacturer's include:

a. Sika Corporation, Lyndhurst, N.J. - Sikadur Hi-mod LV 32; Master Builders, Inc., Cleveland, OH - Concresive 1438 or equal.

b. Overhead applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-mod LV 31; Master Builders, Inc., Cleveland, OH - Concresive 1438 or equal.

D. Repair Mortal

1. General

a. Repair mortal shall be a two-component, polymer modified, cement based, fast-setting, trowel grade, structural repair mortar suitable for use on horizontal, vertical and overhead surfaces prepackaged product specifically formulated for the repair of concrete surface defects.

2. Material

a. Properties of the cured material:

i. Compressive Strength (2 hours 50 percent RH) – 150 psi minimum

ii. Compressive Strength (28 days 50 percent RH) – 150 psi minimum

iii. Bond Strength (pull off method) – 100 percent concrete substrate failure

iv. This system shall conform with ANSI/NSF standards for surface contact with potable water.

3. Approved manufacturer's include:

a. Sika Corporation, Lyndhurst, N.J. – SikaTop 122 PLUS or equal.

b. Overhead applications: Sika Corporation, Lyndhurst, N.J. – SikaTop 123 PLUS or equal.

E. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink Epoxy Grout and Polymer Modified mortar are included in Section 03600 GROUT.

F. Adhesive Capsule type anchor system shall be equal to the HVA adhesive Anchoring System by Hilti Fastening Systems, Tulsa, OK. The capsule shall consist of a sealed glass capsule containing premeasured amounts of polyester or vinylester resin, quartz sand aggregate and a hardener contained in a separate vial within the capsule. Where the adhesive anchor is under sustained tensile loading (i.e. vertically installed anchors) the anchor system shall be Hilti HIT RE-500 SD by Hilti Fastening Systems, Tulsa, OK.

G. Acrylic Latex Bonding Agents shall not be used for this project.

H. Crack Repair Epoxy Adhesive

1. General

a. Crack Repair Epoxy Adhesive shall be a two-component, solvent-free, moisture insensitive epoxy resin material suitable for crack grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.

b. All concrete surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system shall be coated with an acceptable epoxy coating system that conforms with ANSI/NSF standards for surface contact with potable water.

2. Material

a. Properties of the cured material

i. Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.

ii. Tensile Strength (ASTM D638): 5,300 psi minimum at 14 days. Elongation at Break - 2 to 5 percent.

iii. Flexural Strength (ASTM D790 - Modulus of Rupture): 12,000 psi minimum at 14 days (gravity); 4,600 psi minimum at 14 days (injection)

iv. Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.

v. Water Absorption (ASTM D570 - 2 hour boil): 1.5 percent maximum at 7 days.

vi. Bond Strength (ASTM C882): 2,400 psi at 2 days dry; 2,000 psi at 14 days dry plus 12 days moist.

vii. Effective Shrinkage (ASTM 883): Passes Test.

3. Approved manufacturer's include:

a. For standard applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod; Master Builders Inc., Cleveland, OH - Concressive 1380 or equal.

b. For very thin applications; Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod LV; Master Builders Inc., Cleveland, OH - Concressive 1468 or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc, are specified in respective Sections. All work shall comply with other requirements of this of Section and as shown on the Drawings.

B. All commercial products specified in this Section shall be stored, mixed and applied in strict compliance with the manufacturer's recommendations.

C. In all cases where concrete is repaired in the vicinity of an expansion joint or control joint the repairs shall be made to preserve the isolation between components on either side of the joint.

D. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the Engineer. Where possible, rebar locations shall be identified prior to drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

3.02 CONCRETE REMOVAL

A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer, shall be done by line drilling at limits followed by chipping or jack-hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged. Sawcutting at limits of

concrete to be removed shall only be done if indicated on the Drawings, or after obtaining written approval from the Engineer.

B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4-in.

C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1-in deep saw cut on each exposed surface of the existing concrete.

D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the Engineer.

E. The Engineer may from time to time direct the Contractor to make additional repairs to existing concrete. These repairs shall be made as specified or by such other methods as may be appropriate.

3.03 SURFACE PREPARATION

A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs or modifications as shown on the Drawings, specified herein, or as directed by the Engineer.

B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e. - sandblasting, grinding, etc, as approved by the Engineer. Be sure the areas are not less than 1/2-in in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.

C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc, as approved by the Engineer. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2-in. Reinforcing to be saved shall not be damaged during the demolition operation.

D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent or lapped to new reinforcing as shown on the Drawings and provided with a minimum cover all around as specified on the contract drawings or 2-in.

E. The following are specific concrete surface preparation "methods" are to be used where called for on the Drawings, specified herein or as directed by the Engineer. All installation of anchors shall be according to the manufacturer’s recommendations.

1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water. Brush on a 1/16-in layer of cement and water mixed to the consistency of a

heavy paste. Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.

2. Method B: After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface. The field preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.

3. Method C: Drill a hole 1/4-in larger than the diameter of the dowel. The hole shall be blown clear of loose particles and dust just prior to installing epoxy. The drilled hole shall first be filled with epoxy paste, and then dowels/bolts shall be buttered with paste then inserted by tapping. Unless otherwise shown on the Drawings, deformed bars shall be drilled and set to a depth of ten bar diameters and smooth bars shall be drilled and set to a depth of fifteen bar diameters. If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.

4. Method D: Combination of Method B and C.

5. Method E: Capsule anchor system shall be set in existing concrete by drilling holes to the required depth to develop the full tensile and shear strengths of the anchor material being used. The anchor bolts system shall be installed per the manufacturer's recommendation in holes sized as required. The anchor stud bolt, rebar or other embedment item shall be tipped with a double 45 degree chamfered point, securely fastened into the chuck of all rotary percussion hammer drill and drilled into the capsule filled hole.

3.04 GROUTING

A. Grouting shall be as specified in Section 03600.

3.05 CRACK REPAIR

A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks per manufacturer's recommendations. If cracks are less than 1/16-in in thickness they shall be pressure injected.

B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant through valves sealed to surface with crack repair epoxy adhesive per manufacturer's recommendations.

END OF SECTION

DIVISION 4
MASONRY

SECTION 04230

REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all materials, equipment and labor required to complete the reinforced unit masonry construction in accordance with the Drawings and Specified herein. Coordinate all work with that of other trades.

B. The work under this section includes, but is not necessarily limited to, the following:

1. Split-face concrete masonry units (CMU)
2. Reinforced CMU block and lintels
3. Masonry reinforcing, ties, and anchors
4. Grouting for masonry work

1.02 QUALITY ASSURANCE

A. Prior to construction of any masonry buildings, sample wall sections shall be constructed in location(s) approved by the County, to establish a standard of quality for masonry construction for the entire Project. A sample wall section shall be constructed for each type of concrete masonry units (standard, split-face, etc.) to be used on the Project. Include 1 complete exterior and interior control joint to be caulked. Each sample wall section shall have a minimum of 50-square feet of wall face and shall be at least 6 block courses high and 12.67-feet long. For multi-colored, split-face CMU sample walls, at least 3-courses shall be constructed for each color of split-face CMU to be used on the Project. The sample wall(s) will be inspected and approved by the County and shall be maintained by the Contractor throughout the length of the project for use as the "standard of quality" for comparative purposes with masonry walls constructed on the Project. Sample wall section(s) shall be removed by the Contractor upon substantial completion of the Project.

1.03 SUBMITTALS

A. Submit shop drawings, product data, mixes, etc., in accordance with Section 01300.

B. Submit complete shop drawings, including bar lists and placement drawings Comply with ACI 315 “Details and Detailing Concrete Reinforcement”. Include elevations of all reinforced walls showing reinforcement.

C. Submit manufacturer's certifications that all masonry units meet or exceed all specified standards.

D. Product data for split-face CMU types indicating composition, shape, surfaces, and dimensions.

E. Submit 3 color samples for integral colored split-faced concrete masonry units and colored mortar mixers.

F. Submit catalog data for metal ties and anchors, joint reinforcement, and control joint material.

G. Samples of split-face CMU illustrating face profile, color range, surface, and tecture.

H. Installation instructions.

PART 2 - PRODUCTS

2.01 MASONRY UNITS

1. Split-Face concrete masonry units

   a. Standard and lightweight CMU shall conform to ASTM C90, Grade N, Type I, as shown on the Drawings.

   b. CMU shall be free from substances that will cause staining or pop-outs and shall be fine, even textured with straight and true edges. All units shall have been wet steam cured for at least 18-hours and then air cured in covered storage for not less than 28-days before delivery. Units shall have a maximum linear drying shrinkage of 0.25% (percent) (ASTM C426) and have a moisture content at time of delivery not exceeding 30% (percent) of total absorption.

   c. Split-face CMU's for interior and exterior walls where indicated on the Drawings, shall be as manufactured by DeMaco Corporation, Rockblock, Inc., or approved equal. Units shall have 8-inch by 16-inch nominal face size. Matching end and corner units shall be selected from samples provided by the block manufacturer. Split-face units shall be high strength units having a minimum compressive strength of 3,000 psi for any 1-unit. Minimum acceptable water absorption rate shall be 6% of the oven dry weight of the masonry unit in pounds per cubic feet. Split-face CMU's shall be factory prefinished with an integral coloring agent that is added during the mixing process. The coloring agent used for this project shall be from the same lot and batch numbers. The color for the split-face CMU's shall be selected by the County from the CMU manufacturer's standard color samples.

d. CMU noted as fire rated on the Drawings shall conform to Underwriters Laboratories, Inc. Standard for Concrete Masonry Units UL618, and shall have a 2-hour fire resistant rating.

e. All split rib CMU shall have a height minimum of 7-1/2-inch equally spaced 3/4-inch deep by 3/4-inch wide bevels. The projected face shall have a rough texture.

f. Units shall be obtained from 1 manufacturer to ensure even color and texture.

g. Provide special units required by the Drawings including solid, corner, pilaster, lintels, and jamb units.

h. Split-face CMU units shall be Dillon Company, Swords Creek Virginia or DeMaco Concrete Products, Sarasota Florida.

2. Concrete Masonry Units

a. CMU's for structures shall conform to ASTM C90, Grade N, Type II normal weight units with minimum compressive strength of 3,000-psi.

b. Vertical Reinforcing: Provide as shown on the Drawings.

3. Integral Water Repellent

a. Provide units made with integral water repellant for exposed units. Integral water repellant to be a liquid polymeric admixture that does not reduce flexural bond strength. Integral water repellant shall be ACM Chemistries; Rainbloc, Grace Construction Products; Dry-Block or equal.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM Designation A615, Grade 60, unless otherwise specified. Single width reinforcement shall be ladder or truss type, fabricated with a single pair of galvanized 9-gauge side rods and continuous 9-gauge cross-rods spaced not more than 16-inches on center

B. Galvanized dovetailed anchor slots shall be Heavy Filled, Catalog Number 8334 by Vulcan Metal Products, Inc. or equal, and shall be 5-inches long, 16-gauge galvanized.

C. Dovetail anchors shall be placed at 16-inches on center for anchorage to concrete framework or walls.

D. Corrugated non-ferrous 16-gauge metal ties manufactured for use with the anchor slots provided shall be spaced at a maximum of 8-inches on center vertically and 16-inches on center horizontally.

E. The Contractor shall provide and install miscellaneous anchors and attachment members required both for the anchorage of his own work and that of other trades

requiring attachment to masonry, which are not specifically provided under separate sections.

F. Control joints shall be factory extruded preformed styrene-butadiene-rubber compound, conforming to ASTM D2000 2AA805 and shall be as manufactured by Dur-O-Wal, Hohmann and Bernard, Inc., AA Wire Products or equal. Control joints shall be installed as shown on the Drawings.

G. Weep holes shall be 1/4-inch outside diameter by 4-inches long, clear plastic tubing that will not strain brickwork, by Hohmann and Bernard, Inc., or equal.

H. Cleaning compound shall be mild, non-caustic detergent solution such as 801 Super Real Clean by Superior Manufacturing Co., or 600 Sureclean by Process Solvent Co., Inc., or equal.

2.03 MASONRY LINTELS

A. General: Provide precast or built-in-place masonry lintels in compliance with the requirements below.

B. Built-in-place masonry lintels:

1. Built-in-place lintel to be made from lintel and bond beam concrete masonry units with reinforcing bars places ad indicated and filled with grout.
2. Lintels shall be of length sufficient to bear 8” on either side of opening.
3. Temporarily support all built-in-place lintels until cured.

C. Pre-cast concrete lintels:

1. U-Lintel units, minimum compressive strength: 3500 psi at 28 days.
2. All units shall have sand block finish
3. Manufacture and tolerances shall be in compliance with PCI MNL-116, “Manual for Quality Control for Precast and Prestressed Concrete.”
4. Manufacturer shall rate U-lintel units for gravity, uplift, and lateral loads in units of pounds per linear foot, and provide load vs. deflection data.
5. Lintels shall be of length sufficient to bear 8” on either side of opening.

2.04 MORTAR AND GROUT MATERIALS

A. Portland Cement shall conform to ASTM C150 Type II requiring only sand and water for mixing. Masonry cements may be used for colored mortar when specifically accepted.

B. Lime for masonry mortar shall be hydrated, conforming to ASTM C207, Type S.

C. Sand shall be clean, durable particles, free from detrimental amounts of organic matter. The sand shall conform to the limits of ASTM C14. Sand for grout shall conform to ASTM C144 or C33 as required.

D. Water shall be potable, free from detrimental amounts of oils, acids, alkalis, or organic matter, and shall be clean and fresh.

E. Masonry cements used for integral colored CMU's shall be specifically approved for colored mortar. Colored mortar mixers shall be factory premixed with color pigments and Portland cement, requiring only sand and water for mixing. Colored mortar for the project shall be from the same factory lot and batch numbers. Color of the mortar mix shall be selected by the Owner from the mortar manufacturer's standard color samples.

F. Water repellent admixture added to mortar shall match water repellent used in manufacture of split-face CMU.

G. Strength of mortars shall exceed 1,800-pounds per square inch, when tested with 2-inch cubes at the end of a 28-day aging period.

H. Grout for setting bearing plates, machinery, or any other non-masonry use shall be as specified in Section 03600 "Grouting."

I. Grout

1. Portland cement shall conform to ASTM C150, Type I.
2. Aggregates shall conform to ASTM C144.
3. Grout for constructing CMU lintel blocks and for grouting cores to receive embedded anchors or reinforcing shall conform to ASTM C476, fine or coarse grout. Strength shall be 2,500-psi minimum at 28-days. Grout will have a slump of 10-inches, plus or minus 1-inch, at time of placement.
4. Concrete grout for filling structural CMU cells shall use 3/8-inch pea rock mix with a minimum compressive strength of 3,000-psi.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Provide formwork and shores as required for temporary support of reinforced masonry elements. Design, erection, support, bracing, and maintenance of formwork are the Contractor's responsibility.

B. Construct formwork to conform to shape, line, and dimensions shown and sufficiently tight to prevent leakage of mortar grout or concrete.

C. Do not remove forms and shoring until reinforced masonry member has hardened sufficiently to carry its own weight and all other reasonable temporary loads that may be placed on it during construction. Do not remove forms and shoring supporting the weight of concrete in beams, slabs, and other members until concrete has attained its specified 28-day compressive strength.

3.02 MORTAR

A. Mortar shall be machine mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. The mixing time shall not be less than 5-minutes, approximately 2-minutes of which shall be for mixing the dry materials and not less than 3-minutes for continuing the mixing after the water has been added. Where hydrated lime is used for mortar requiring lime content, the Contractor will have the option of using the dry-mix method or first converting the hydrated lime into putty.

B. Where the dry-mix method is employed, the materials for each batch shall be well turned over together until the even color of the mixed, dry materials indicates that the cementitious material has been distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.

C. Mortar that has begun to set shall not be used.

D. Mortar shall be used and placed in final position within 1-1/2 hours after mixing.

E. Mortar boards and boxes shall be cleaned at the end of each days work, and all tools shall be kept clean.

3.03 LAYING CONCRETE BLOCK

A. Do not wet concrete masonry units (CMU).

B. Masonry shall not be laid at temperatures below 40°F, without the approval of the Owner, and all work shall be done in such a manner as to insure the proper and normal hardening of all mortar. All masonry work shall be so protected and heated that the temperature at the surface will not fall below 50°F for a period of 72-hours after placing. Any completed work found to be affected by cold weather shall be taken down and rebuilt by the Contractor at his expense.

C. All CMU shall be laid in a full bed of mortar. Butter the vertical joint of unit already set in the wall and all contact faces of the unit to be set. Each unit shall be placed and shoved against the unit previously laid so as to produce a well compacted vertical mortar joint for the full thickness. Units shall be set with all cells in a vertical position. The moisture content of the units when laid shall not exceed 35% (percent) of the total absorption as determined by laboratory test. Split-face CMU's shall be

laid with the horizontal stringline control to the inside face of block in a full bed of mortar on all 4 sides.

D. Masonry units shall be laid in a running bond unless otherwise shown.

E. Sizes shall be as specified and called for on the Drawings and where "Soaps" and "Splits" are used, the space between these members and the backup material shall be slushed full of mortar.

F. Masonry joints which are exposed to view shall be tooled in accordance with the following:

1. Wait until unit mortar is thumbprint hard before tooling joint.
2. Both vertical and horizontal joint spacing shall be uniform.
3. Joints for CMU shall be 3/8-inch.
4. Joints for structural block shall be 1/4-inch.
5. Joints shall be tooled slightly concave.
6. Joints for standard CMU shall be rubbed with a sponge to provide a flush, neat, rubbed joint.
7. Exterior joints for split-face CMU shall be rubbed with a sponge, paddle, or Styrofoam tool to cause the joint to blend with the masonry unit's exterior split-face. Interior face joints of split-face CMU shall match standard CMU joints.

G. Install all frames required to be set in masonry. Set masonry tightly against frames, build in and mortar in all frame anchors and fill frames solid with mortar.

H. Control joints shall be installed at the intersection of masonry walls with structural concrete members and elsewhere as detailed on the Drawings. Joints shall be raked out to a depth of 3/4-inch for the full height or full width of the wall suitable for caulking. The maximum length, horizontally, between vertical control joints shall be 40-feet, but joints shall be located only as directed or shown. Joints shall be equal in width to the standard mortar joint.

I. All masonry slots, chases, or openings required for the proper installation of the work of other sections shall be constructed as indicated on the Drawings or in accordance with information furnished before the work is started at the points affected. No chase shall be cut into any wall constructed of hollow units after it is built, except as directed by the County.

J. Field cut split-face CMU with power tools to provide straight true edge and avoid damage to split-face. Do not install chipped or broken units.

K. Exercise care that wet mortar is not splashed onto split-face during installation. Excess or splashed mortar shall be cleaned from face with a burlap wipe.

L. During grouting, placement of foamed-in-place insulation, and application of sealants, ensures that materials are not smeared onto split-faces of CMU. Remove smeared materials as recommended by manufacturer.

M. Surfaces shall be brushed as work progresses and maintained as clean as practical. Unfinished work shall be raked back where possible, and toothed only where absolutely necessary. Before leaving fresh or unfinished work, walls shall be fully covered and protected against rain and wind, and before continuing work, previously laid surfaces shall be swept clean. The tops of walls or other unfinished work shall be protected against all damage by frost or the elements by means of waterproof paper, tarpaulins, boards, or other means reviewed by the County.

N. The Contractor shall build in all miscellaneous items to be set in masonry for which placement is not specifically provided under separate Divisions, including reglets, lintels, ties, electrical panel boxes, sleeves, vents, grilles, anchors, grounds and exterior electrical conduits, and fixtures, and shall cooperate with other trades whose work is to be coordinated with the work under this Section.

O. All anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar or grout.

P. All ties and reinforcing for masonry shall be furnished and installed by the Contractor.

Q. Loose lintels shall be set in a full bed of mortar and supported by solid or mortar filled hollow concrete blocks as detailed on the Drawings.

R. Bed and grout all items coming in contact with masonry where grouting is required, including door bucks and frames set in masonry. The Contractor shall install all anchor bolts, base plates, and seats in masonry walls, and build in all items required for the completion of the building as they apply to masonry.

S. Block work shall be laid plumb, level, and true to line and grade. Lay block within the following tolerances from specified dimensions:

1. Mortar joint thickness: Bed-1/8 inch; Head- ¼ inch, +3/8 inch
2. Variation from plumb, level, and line: ¼ inch in 10 feet, 3/8 inch total

T. Where solid CMU units are shown, lay units with full mortar head and bed joints.

U. Walls

1. Pattern Bond: Lay CMU wall units as specified in Section 04050 "Masonry." Bond and interlock each course at corners and intersections and use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams, and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clearance and grout coverage for vertical

reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

4. Option: Where all vertical cores are not shown to be grouted, Contractor may elect to fill all vertical cores with grout, in which case, requirements for mortar bedding of cross-webs and closing of core spaces below bond beams will not apply.

V. Columns, Piers, and Pilasters

1. Use CMU of the size, shape, and number of vertical core spaces shown. If not shown, provide units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.

2. Provide pattern bond as shown, or if not shown, provide alternate head joints in vertical alignment.

3. Where bonded pilaster construction is shown, construct wall and pilaster units together to the maximum pour height specified.

3.04 PLACING REINFORCEMENT

A. Clean reinforcement of loose rust, mill scale, earth or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Place reinforcement straight, centered in cells, and tied at laps and intersection of bars. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.

C. For columns, piers, and pilasters, provide a clear distance between vertical bars as shown, but not less than 1-1/2-times the nominal bar diameter or 1-1/2-inches, whichever is greater. Provide lateral ties as shown.

D. Splice reinforcement bars only as shown. Do not splice at other points unless approved by the Engineer. Provide lapped splices, unless otherwise shown. In splicing vertical bars or attaching to dowels, tie splices with wire.

E. Provide not less than the minimum lap shown, or if not shown, as required by governing code.

F. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8 inch on exterior face of walls and 1/2 inch at other locations.

G. Anchor reinforces masonry work to supporting structure as indicated.

3.05 GROUTING

A. Use fine grout for filling spaces less than 4 inches in both horizontal directions.

B. Use course grout for filling 4 inch spaces or larger in both horizontal directions.

C. Place grout within 1.5 hours from introducing water in the mixture and prior to initial set.

D. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to the requirements which follow.

E. Consolidate grout by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

F. Low-Lift Grouting:

1. Provide a minimum clear dimension of 2 inches and clear area of 8 sq. in. in vertical cores to be grouted.
2. Place vertical reinforcement prior to laying of CMU. Extend vertical reinforcement above elevation of maximum pour height as required to allow for splicing and support it in position at vertical intervals not exceeding 192 bar diameters nor 10 feet.
3. Lay CMU to maximum pour height. Limit pour height to 5 feet. If bond beam occurs below the 5 feet height stop, pour at course below bond beam.
4. Preparation of Grout Spaces: Prior to grouting, inspect and clean out the grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond.
5. Pour grout using container with spout or by chute and rod or vibrate during placing. Place grout continuously. Do not interrupt pouring of grout for more than one hour. Terminate grout pours 1 1/2-inches below top course of pour.
6. Bond Beams: Terminate grout in vertical cells 1 1/2-inches below bond beam course. Place horizontal reinforcement in bond beams with corners and intersections lapped as shown. Place grout in bond beam course before filling vertical cores above bond beam.

3.06 PROTECTION

A. During erection: Cover top of walls with waterproof sheeting at end of day. Cover partially completed walls when work is not in progress. Extend 24-inches minimum down both sides and hold securely in place.

B. Protect face of walls, sills, and other projections from roof run-off, water, mud, grout, and mortar.

C. Spread sand or straw at base of walls to minimize dirt and clay splashed.

D. Without damaging completed work, provide protective boards at exposed external corners, which may be damaged by construction activities.

E. Clean installed block at the end of each work day.

3.07 CLEANING

A. All holes in exposed masonry shall be pointed, and defective joints shall be cut out and re-pointed with mortar of same color as that of the original and adjoining work.

B. Exposed masonry shall be protected against staining by wall coverings, and excess mortar shall be wiped off the surface as the work progresses.

C. All masonry shall be cleaned with approved detergent solution in accordance with manufacturer's printed directions. No acid or metal scrapers shall be used on masonry.

D. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 20-square feet in a location reviewed by the County. No further cleaning work may proceed until the sample area has been reviewed by the County, after which time the same cleaning materials and method shall be used on the remaining wall area.

E. After cleaning, treat exposed split-face CMU surfaces and mortar joint sealer applied in accordance with manufacturer's instructions. Verify surfaces are clean and thoroughly dry prior to application.

F. Contractor to notify R.P.R a minimum of 40 hours in advance of all grouting pours with a pour release form, supplied by owner.

END OF SECTION

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DIVISION 5
METALS

SECTION 05500
MISCELLANEOUS METAL

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete joint accessories are included in Section 03350.

B. Masonry reinforcement, ties and accessories are included in Division 4.

C. FRP Doors and frames are included in Section 08100.

D. Painting is included in Division 9.

E. Louvers are included in Division 10.

F. Sluice gates, slide gates, operators and appurtenances, including wall thimbles, are included in Division 11.

G. Pipe hangers and sleeves are included in Division 15.

H. Equipment anchor bolts are included in the respective Sections of Divisions 11, 14, and 15.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
   1. Shop drawings, showing sizes of members, method of assembly, anchorage and connection to other members.

B. Samples:
   1. Submit samples as requested by the Engineer during the course of construction.

C. Design Data:
   1. Submit calculations or test data demonstrating that the railings will resist the loads specified in the 2010 Florida Building Code at the post spacing provided.
   2. Submit manufacturer's load and deflection tables for grating.

D. Test Reports:
   1. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.

E. Certificates:
   1. Submit certification that the railing system is in compliance with OSHA requirements and the 2010 Florida Building Code.
   2. Certify that welders have been qualified under AWS, within the previous 12 months, to perform the welds required under this Section.

1.04 REFERENCE STANDARDS

A. Aluminum Association (AA):
   1. ABH-21 Aluminum Brazing Handbook
   2. ASD-1 Aluminum Standards and Data
   3. DAF-45 Designation System for Aluminum Finishes
   4. SAA-46 Standards for Anodized Architectural Aluminum

B. American Society for Testing and Materials (ASTM):
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A48 - Standard Specification for Gray Iron Castings.
   3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
   5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   7. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
   8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
   9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.
   10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   11. ASTM A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
   12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A536 - Standard Specification for Ductile Iron Castings.
15. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
16. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
17. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
18. ASTM B429 – Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

C. American Iron and Steel Institute (AISI):
   1. Specification for Structural Steel Buildings.

D. American Welding Society (AWS):
   1. AWS D1.1 – Structural Welding Code Steel.
   2. AWS D1.2 – Structural Welding Code Aluminum.

E. Federal Specifications:
   1. FS-FF-B-575C – Bolts, Hexagonal and Square

F. Occupational Safety and Health Administration (OSHA).

G. 2010 Florida Building Code. (FBC).

H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining 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. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Repair items which have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 – PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1. Structural Steel – Wide flange shapes:	ASTM A992
2. Structural Steel – Other Shapes; plates; rods and bars	ASTM A36
3. Structural Steel Tubing	ASTM A500, Grade B
4. Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
5. Steel Sheets	ASTM A366
6. Gray Iron Castings	ASTM A48, Class 35
7. Ductile Iron Castings	ASTM A536, Grade 65-45-12
8. Aluminum Extruded Pipe	ASTM B429, Alloy 6063 T6
9. Aluminum Extruded Shapes	ASTM B221, Alloy 6061 T6
10. Aluminum Sheet and Plate	ASTM B209, Alloy 6061 T6

11. Stainless Steel Plates, Sheets, and Structural Shapes	
a. Exterior, Submerged or Industrial Use	ASTM A240, Type 316 (Type 316L for welded)
b. Interior and Architectural Use	ASTM A240, Type 304
12. Stainless Steel Bolts, Nuts, and Washers	ASTM A276, Type 316
13. Titanium Bolts, Nuts, and Washers	ASTM F468, F467
14. Hastelloy C-276 Bolts	ASTM B574
15. Carbon Steel Bolts and Studs	ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
16. High Strength Steel Bolts, Nuts and washers	ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
a. Elevated Temperature Exposure	Type I
b. General Application	Type I or Type II
17. Galvanizing	ASTM A123, Zn w/0.5 percent minimum Ni
18. Galvanizing, hardware	ASTM A153, Zn w/0.5 percent minimum Ni

2.03 ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchor bolt material shall be ASTM A307, Grade A (hot dip galvanized buts and washers where noted), or ASTM F1554, Grade 36- Standard headed anchor bolts.

B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts.

C. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwick-bolt III; ITW Ramset; Redhead trubolt, or equal.

D. Compound masonry expansion anchors shall be lead expansion sleeve type anchors complete with nuts and washers. Anchors shall be precision die-cast zinc alloy with a minimum of two lead alloy expansion sleeves. When the length or embedment of the

bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Star Expansion Industries, Star Slugin or equal.

E. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti, HVA Adhesive Anchor; Molly, Parabond; Rawlplug, Rawl Chem-Stud or equal.

F. Adhesive anchors, for fastening to hollow concrete block or brick, 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 an all-thread anchor rod with nut and washer. Anchors shall be Hilti, HIT C-20 System or equal.

G. Automatic end welded headed anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors or equal.

H. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

I. Toggle bolts shall be Hilti, Toggler Bolt or equal.

2.06 ACCESS HATCHES

A. Access hatches shall have single or double leaf doors as indicated by the Drawings. The doors shall be 1/4-in aluminum diamond pattern plate with welded stiffeners, as necessary, to withstand a live load of 300 lbs/sq ft with a maximum deflection of 1/150th of the span. Hatches shall have a 1/4-in aluminum channel frame with a perimeter anchor flange or strap anchors for concrete embedment around the perimeter. Unless otherwise noted on the Drawings, use pivot torsion bars for counterbalance or spring operators for easy operation along with automatic door hold open. Hardware shall be durable and corrosion resistant with Type 316 stainless steel hardware used throughout. Provide removable lock handle. Finish shall be the factory mill finish for aluminum doors and frames with bituminous coating on the exterior of the frames in contact with concrete. Hatches shall be watertight and have a 1-1/2-in drainage coupling to the channel frame. Access hatches shall be Types as indicated on the Drawings by Bilco Company, New Haven, CT or equal.

2.07 MISCELLANEOUS ALUMINUM

A. All miscellaneous metal work 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. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.

E. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8-in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 304 stainless steel. Plates shall have a mill finish.

F. Stair treads for aluminum stairs shall have abrasive non-slip nosing as approved.

G. Aluminum nosing at concrete stairs shall be Wooster Products, Inc.; Alumogrit Treads, Type 116; similar by Barry Pattern and Foundry Co.; Andco or equal. Furnish with wing type anchors and flat head stainless steel machine screws, 12-in on center. Nosing shall also be used at concrete ladder openings. Nosing shall a single piece for each step extending to within 3-in at each side of stair or full ladder width. Set nosing flush with stair tread finish at concrete stairs. Furnish treads with heavy duty protective tape cover.

H. Miscellaneous aluminum items shall have a cleaned and degreased mill finish.

2.09 MISCELLANEOUS STEEL

A. All miscellaneous metal work 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. Holes shall be drilled or punched. Edges shall be

smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous steel items shall include: beams, angles, lintels, metal stairs, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.

D. Structural steel angle and channel door frames shall be shop coated with primer. Frames shall be fabricated with not less than three anchors on each jamb.

E. Steel pipe pieces for sleeves, lifting attachments and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe, shall have welded circumferential steel waterstops at mid-length.

F. Lintels, relief angles or other steel supporting masonry or embedded in masonry shall be shop coated with primer.

G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall be omitted within 3-in of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.

H. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 oz/sq ft of surface.

2.08 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work 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. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and 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.

B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.

C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

D. Specialty products shall be installed in accordance with the manufacturer's recommendations.

E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.

F. Install adhesive capsule anchors using manufacture's recommended drive units and adapters and in compliance with the manufacturer's recommendations.

G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.

H. All steel surfaces that come into 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.

I. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

J. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

K. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

L. Between aluminum grating, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4-in thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

END OF SECTION

DIVISION 6
WOOD AND PLASTICS

SECTION 06600

FIBERGLASS REINFORCED PLASTIC FABRICATIONS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes all Fiberglass Reinforced Plastic (FRP) Products and Fabrications, including but not limited to:

1. FRP Molded Grating.
2. FRP Grating Embedment Angle Frames.
3. FRP Structural Fabrications.

1.02 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals as required for the provision and proper installation of all of the FRP Products as shown on the Drawings and specified herein. All anchor bolts, gaskets, sealants, and other accessories and appurtenances, required for a complete and operating installations shall be included whether specifically mentioned or not.

1.03 REFERENCES

A. ANSI/NSF 61: Drinking Water System Components – Health Effects.

B. ANSI/AWWA F101: Contact-Molded, Fiberglass-Reinforced Plastic Wash Troughs, and Launders.

C. ASTM D 638: Standard Test Method for Tensile Properties for Plastics.

D. ASTM D 695: Standard Test Method for Compressive Properties of Rigid Plastics.

E. ASTM D 790: Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.04 QUALITY ASSURANCE

A. All FRP Products and Fabrications shall be supplied by an experienced firm that has continually engaged in the manufacture and/or fabrication of fiberglass reinforced plastics. Firms not listed in this specification must clearly document a minimum of three years experience with similar projects of equal scope of design.

B. Contractor shall ensure that all field dimensions are taken accurately and communicated properly to the FRP Fabricator, that other trades will not affect a proper installation of the FRP, and that all manufacturer's instructions and recommendations are followed.

1.05 DESIGN REQUIREMENTS

A. All fabrication shall comply with OSHA – 29 CFR as it pertains to worker safety and walking-working surfaces for stairs, ladders, handrail, and platforms.

1.06 SUBMITTALS

A. Submit complete shop drawings and product data for all FRP materials and fabrications as required to show compliance with these specification, including:
   1. Product Data.
   2. Manufacturers catalog data with load and deflection charts for all FRP Gratings.
   3. Manufacturers catalog data for all FRP Structural Shapes.
   4. Upon request, manufacturers' 6-inch square samples of FRP laminate of the same construction, thickness, and color as the structural item.
   5. Test results of FRP laminate.
   6. Installation instructions
   7. Manufacturer’s certification that materials comply with specified requirements and are suitable for the intended application.

B. Shop Drawings:
   1. Shop drawings shall show all FRP materials as required and include all dimensions, connections, fasteners, structural supports, adjustments, openings, anchors, tolerances, assembly, and installation details as required.

PART 2 – PRODUCTS

2.01 GENERAL

A. All FRP materials shall be manufactured with vinyl ester, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

B. All structural shapes shall be constructed of continuous strand roving, continuous transverse mat, and synthetic surface veil, and shall include ultraviolet (UV) inhibitors.

C. All structural grating and shapes shall be flame retardant per ASTM E-84 Class 1 Flame Spread equal to or less than 25.

D. After fabrication of FRP, all cuts, holes, and abrasion shall be sealed according to MANUFACTURER'S instructions to prevent corrosion.

2.02 FRP GRATING

A. FRP grating to be molded fiberglass grating made with vinyl ester.

B. Grating to be 1-5/8-inch thick with a grid pattern of 1½-inch x 1½-inch.

C. Color shall be dark green.

D. FRP grating shall be designed to support 100 lbs. per square foot uniform load. Deflection shall not exceed 0.25 inches.

E. All molded grating shall have ultraviolet (UV) inhibitors.

F. Grating shall have integral embedded grit to a nominal depth of 3/16-inch for slip resistance.

G. The top and bottom bars of the bearing bars and cross bars of the grating shall be in the same plane.

H. All platform grating shall be attached with type 316 stainless steel grating clips. Minimum of four clips per piece.

I. Grating shall be manufactured by Fibergrate, Seasafe or approved equal.

2.03 FRP EMBEDMENT ANGLE FRAMES

A. All FRP grating set in concrete openings shall have a FRP embedment angle frame.

B. Embedment angle frame to be EBA-10, EBA-15, or EBA-20 as required for the thickness of grating specified above.

C. Embedment angle shall have a continuous integral anchor.

D. FRP embedment angle frames shall be vinyl ester resin.

E. Grating shall be manufactured by Fibergrate, Seasafe or approved equal.

2.04 FRP STRUCTURAL FABRICATIONS

A. FRP structural shapes shall be vinyl ester pultruded fiberglass shapes. All shapes shall meet ASTM E-84 Class 1 Flame Spread equal to or less than 25 and ASTM D-635 self-extinguishing.

B. The minimum physical properties shall be:

Property	ASTM	Longitudinal Direction	Transverse Direction
Tensile Stress	D-638	30,000 psi	7,000 psi
Tensile Modulus	D-638	2.5×10^6 psi	0.8×10^6 psi
Compressive Stress	D-695	30,000 psi	15,000 psi
Compressive	D-695	2.5×10^b psi	1.0×10^bpsi
Flexural Stress	D-790	30,000 psi	10,000 psi
Flexural Modulus	D-790	1.8×10^6 psi	0.8×10^6 psi
Modulus of Elasticity, E	Full Section	2.8×10^b psi	---

C. All structural shapes shall be fabricated per the drawings with commercial labor, closely fitted joints, and finished true to line and in accurate position to permit installation and proper joining of parts in the field.

D. Use type 316 stainless steel bolts and washers.

E. All joint surfaces to be bonded shall be abraded to remove surface gloss and be free of burrs and other foreign materials that would prevent proper adhesion.

F. Use high-strength epoxy adhesives designed for FRP use and mechanical fasteners.

G. All pieces to have easily identified part numbers or pieces marks.

H. Shop assemble pieces into the largest practical assembly suitable for shipping.

I. FRP structural fabrications shall be manufactured by Fibergrate, Seasafe or approved equal.

2.05 MOLDED COVERED FRP GRATING

A. Manufacture: Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane.

B. Grating shall have a square mesh pattern. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement in the grating panel shall be no more than 3/16-inch below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements.

C. After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, resin rich resin starved areas.

D. The grating cover plate shall be attached to the completed panel of grating by chemical means to ensure integral action of the panel and plate. The panel and grating shall be uniformly clamped together to ensure that all contact surfaces remain in contact throughout the curing process.

E. Non-slip Surfacing: Covered grating shall have a gritted surface.

F. Grating bar intersections are to be filleted to a minimum radius of 1/16-inch to eliminate local stress concentrations and the possibility of resin cracking at these locations.

G. Fire Rating: Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E 84. Certifications shall be dated within the past two year and test data performed only on the resin shall not be acceptable.

H. The resin system used in the manufacture of the grating shall be vinyl ester. Manufacturer may be required to submit corrosion data from tests performed on actual grating products

in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating product corrosion resistance and shall not be accepted.

I. Color shall be dark grey.

J. Depth: 2 1/8-inch with a tolerance of plus or minus 1/16-inch.

K. Mesh Configuration of Grating: 2-inch x 2-inch with a tolerance of plus or minus 1/16-inch centerline to centerline.

L. Covered grating load/deflection requirements at the required span (shown below) shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be designed for a uniform load of 100 psf or concentrated load of 300 lb. Deflection is not to exceed 0.375-inch of L/D = 120, whichever is less.

M. Grating shall be manufactured by Fibergrate, Seasafe or approved equal.

PART 3 – EXECUTION

3.01 INSPECTION

A. Upon receipt of material at job site, the contractor shall inspect all materials for shipping damage. Any damage is to be noted on the shipping receipt/packing list and reported promptly to the shipper.

3.02 HANDLING AND STORAGE

A. Handle all FRP materials with reasonable care to prevent damage. Use shipping pallets to move materials.

B. If FRP materials are not to be installed immediately, then store to prevent twisting, bending, breaking, or damage of any kind.

3.03 INSTALLATION

A. Installing contractor to coordinate and verify that other construction trades and materials have been installed per the contract drawings, and, that they are accurate in location, alignment, elevation, and are plumb and level.

B. Install FRP materials in accordance with the installation drawings and instructions supplied by the FRP supplier.

C. Install materials accurately in location and elevation, level, and plumb. Field fabricate as necessary for accurate fit.

D. Troughs shall also be installed square, in true and proper alignment without warp or twist, within the tolerances specified by the manufacturer and as indicated herein. Troughs shall be set with weir edges to the elevations indicated on the

drawings. Grout in place after leveling, and adjust lengths of plates as necessary under direction of manufacturer and engineer.

E. All field cuts, holes or abrasions must be sealed with Manufacturer's sealing resin according to Manufacturer’s instructions to prevent corrosion.

F. If the scope of work requires the contractor to perform additional tasks, which may damage the installed FRP materials, the contractor is responsible for covering grating with plywood, or other suitable protective material.

END OF SECTION

DIVISION 7
THERMAL AND MOISTURE PROTECTION (NOT USED)

DIVISION 8
DOORS AND WINDOWS

SECTION 08345

FIBERGLASS REINFORCED PLASTIC DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes all Fiberglass Reinforced Plastic (FRP) Doors and Frames.

1.02 PERFORMANCE REQUIREMENTS

A. Exterior FRP doors shall be designed to meet wind-loading requirements for the 2014 FBC. Refer to Structural Drawings for wind and design pressures.

1. All exterior door assemblies shall be compliant with Florida Building Code rule 9N-3 for statewide product approval and require a Florida Product approval number.

1.03 SUBMITTALS

A. Product Data:

1 Printed data of FRP door detailing internal construction and reinforcements, materials used and description of molding process.

2 Instructions for handling and care of products.

3 Recommended maintenance procedures

B. Shop Drawings:

1 Show types, sizes, pertinent dimensions, FRP thickness, finish, details of construction, anchorage, fastenings, bracing, closure method, coordination with hardware, appurtenances, and installation details for units.

2 Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.

3 Indicate coordination of glazing frames and stops with glass and glazing requirements.

4 Shop drawings for exterior door assemblies shall be signed and sealed by a licensed engineer registered in the State of Florida.

5 Calculations for wind load design for exterior door assemblies shall be stamped, sealed and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE 7-10.

C. Samples: Full set of actual material sections of available finish colors, to be selected by Owner.

D. Certifications:

1 Certification that product furnished meets or exceeds requirements specified

2 Manufacturer’s and installer’s qualifications

E. Sample warranty

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in the manufacture of FRP doors and frames with a minimum of five years documented experience.

B. Installer: An experienced installer who has completed FRP door and frame assembly installations similar to the Project requirements.

C. Source Limitations: Provide FRP door and frame assemblies by a single manufacture.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver to Site in sealed, undamaged containers identified with manufacturer's name, project name and identification tag number. Identifying tag numbers must be related to those used in the Contract Documents.

1. Deliver in crates with foam or other internal protection means.

2. Inspect units upon delivery for damage. Reject damaged goods.

B. Storage:

1 Store in original cartons, on edge in such a way to prevent falling or damage to cartons, on corners and edges.

2 Store doors and frames onsite in area where there will be no great variation in heat and humidity.

3 Doors and frames shall be stored vertically at the least possible angle. Do not horizontally.

C. Handling: Comply with manufacturer’s written instructions

1.06 WARRANTY

A. Provide manufacturer’s 10 year (minimum) warranty for defects in material and workmanship of the FRP door and frame assembly. Warranty shall include warp, separation or delamination from core, expansion of core, failure due to incorrect installation, and corrosion from the specified environment named at time of purchase. Warranty shall not extend to failure caused by physical abuse.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers:

1 Tiger Door, LLC.

2 Chem-pruf Door Co., Ltd.

B. Products of other manufacturers will be considered provided they equal or exceed the material requirements and design qualities of the specified product. Submit requests to Architect per Division 01 requirements.

2.02 DOORS

A. Doors: Fiberglass reinforced plastic (FRP) resins, 1 3/4-inch thick, flush with an insulation value of R-10 minimum.

B. Stiles and Rails: FRP rectangular tube sub frame of manufacturer's standard construction meeting wind loading and fire rating requirements and allowing for hardware mortises. No wood blocking or metallic plates will be allowed.

C. Core: Manufacturer's standard phenolic resin impregnated honeycomb core.

D. Reinforcement: Additional reinforcement as required per manufacturer's tested assemblies to meet wind loading.

E. Lites: Window openings shall be molded integrally with both door plates, totally sealed so that no moisture may penetrate the door cavity. Install glazing per manufacturer's instructions.

F. Louvers: Molded solid vanes, gelcoat to match color and sheen of door skin.

2.03 FRAMES

A. Manufacturer's standard meeting performance requirements.

B. Color and finish to match door.

C. Internal Reinforcement: Continuous within the structure allowing for mounting of specified hardware. Dissimilar materials, such as steel, will be deemed unacceptable as reinforcement for hardware attachment.

2.04 ACCESSORIES

A. Fasteners: Type 316 stainless steel.

B. Hardware: Provide hardware as scheduled that has been tested as part of the door and frame assembly for wind loading.

2.05 FABRICATION

A. Fabricate FRP door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

1. Clearances: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between non-fire-rated pairs of doors. Not more than 3/4 inch at bottom.

B. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

C. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of manufacturer for door and frame preparation for hardware.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that doors and frames comply with approved shop drawings and meet the indicated requirements for type, size, hardware, location and swing.

B. Examine openings for conditions that would prevent proper installation. Do no proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install door and frame assemblies in accordance with manufacturer's written instructions, meeting specified performance requirements.

3.03 ADJUST AND CLEAN

A. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

B. Protect doors and frames from damage during subsequent construction activities.

C. Damaged work will be rejected and shall be replaced with new work at no additional cost to the Owner or Architect.

D. Clean exposed surfaces with a mild, non-abrasive cleaner and water.

END OF SECTION

SECTION 08700
FINISH HARDWARE

PART 1 - GENERAL

1.01 SCOPE

A. This section covers finish hardware for FRP doors together with cylinder and padlocks which must be keyed to match door locks.

1.02 RELATED WORK

A. Fiberglass Reinforced Plastic Doors and Frames are furnished in Section 08345.

1.03 TEMPLATES

A. Each hardware manufacturers shall deliver to the door and frame manufacturer a template for each item of mortised and surface-applied hardware. Each template shall be labeled with the manufacturer's name, hardware item, opening number, and location on the door or frame where the item is to be installed.

1.04 SUBMITTALS

A. A complete schedule of finish hardware shall be submitted in accordance with the submittals section. The schedule shall indicate each item of hardware required for each item of hardware required for each opening, manufacturer's name, manufacturer's number or symbol, and finish.

1.05 PACKAGING

B. Each item of hardware shall be packaged separately in an individual container complete with screws, keys, special wrenches, instruction, and installation templates necessary for accurately locations, setting, adjusting, and attaching the hardware. Each container shall be marked with the number of the opening to which the hardware item is to be applied.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The catalog numbers which appear in the Hardware Schedule indentify products of the first-named of the manufacturers listed herein for each hardware item. Equivalent products of the other manufactures listed herein will also be acceptable.

1. Butts and Hinges: Stanley, Hafer, or Lawrence

2. Locksets, latchsets, cylinders, and padlocks: Corbin-Russwin (No exceptions)

3. Electric Strikes: Von Duprin

4. Exit devices: Von Duprin, Russwin, or Corbin

5. Closers: LCN, Sargent, or Russwin.

6. Holders, bumpers, and silencers: Glynn-Johnson, Russwin, or Corbin.

7. Thresholds, cast abrasive : Wooster, American Abrasive, or Stubbs.

8. Thresholds and drip caps, extruded : Reese, Zero, or NGP.

9. Flush Bolts : Glynn-Johnson, Ives, or Quality.

10. Automatic flush bolts: Glynn-Johnson or Ives.

11. Surface Bolts : Glynn-Johnson, Ives, or Baldwin.

12. Push plates, pull plates, and kickplates : Baldwin or Quality.

13. Weatherstripping and automatic door bottoms: Resse, Zero, or Pemko.

14. Smoke Gasketing : Reese, Zero, or Pemko

15. Coordinator for double doors: Glynn-Johnson or Ives.

B. Exterior surfaces of door closers shall be shop primed and finish painted with shop-applied aluminum paint. Machine screws, bolts, and other exposed attachments shall be finished to match hardware.

C. Finish: The required finish shall be as indicated by the catalog number listed in the Hardware Schedule.

D. Keying: All cylinder locks and padlocks shall be keyed in groups. Two keys shall be furnished with each lock. All locks in each group shall be keyed alike and each group shall be keyed differently. All locks shall be operable by a master key or by master key groups and a grand master key. Six master keys shall be furnished. The keying system shall be compatible with Owners present system wide keying system.

E. Silencers: Hard rubber silencers shall be provided for all door frames that are not being

weather stripped. Door frames are prepared for three silencers per jamb and two per head.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Hardware shall be accurately fitted, securely applied, carefully adjusted, and lubricated in accordance with the manufacturer's instructions.

B. Location: Unless otherwise direction by the Engineer, the locations of hardware items shall be in accordance with the DHI "Recommended Locations for Building' Hardware for Standard Steel Doors and Frames".

C. Thresholds: The ends of thresholds shall be notched to fit the applicable door frame profile. Thresholds shall be field drilled to receive flush bolts where required. Thresholds shall be anchored to concrete by means of 5/16 inch (8mm) diameter stainless steel flat head countersunk machine screws and expansion anchors spaced at 8 inch (200mm) centers. Thresholds shall be set in asphalt roofing cement conforming to ASTM D4586, Type II.

D. Adjusting: Each supplier of finish hardware shall provide the service of a trained and experienced hardware consultant to service and adjust installed hardware.

E. Protection: Special care shall be taken to protect finished surfaces of hardware during installation. Hardware on which the finish has been damaged prior to final acceptance of the work shall be replaced with new hardware at no additional cost.

3.02 HARDWARE SCHEDULE

A. Hardware shall be furnished in accordance with the following schedule. Doors are listed by opening number. A complete set of hardware is listed for each opening. Any item of hardware normally required by good practice, or as to meet state or local codes, shall be furnished even though it may not specifically be mentioned. All fasteners for door hardware shall be stainless steel unless noted otherwise.

Set No.	Item	No. Req'd	Catalog No.
Set 1	Butts	8	FBB199-US32D-41/2" x 41/2" w/ security pin
	Exit Device (Active)	1	9847L-US32D
	Exit Device (Inactive)	1	9847EO-US32D
	Closer (Active)	1	4040H-Cush
	Flush Bolts (Inactive)	2	FB458N-630
	Coordinator	1	GJCOR-4-US32D
	Threshold	1	513SS 1/2"x 5"
	Weather Striping		
	Head/Jamb	1	779D
	Sill	1	323D
Set 2	Butts	3	FBB199- US32D -41/2" x 41/2" w/security pin
	Exit Device	1	9847L-US32D
	Closer	1	4040H-Cush
	Threshold	1	513SS 1/2"x 5"
	Weather Striping		
	Head/Jamb	1	779D
	Sill	1	323D

END OF SECTION

DIVISION 9
FINISHES

SECTION 09220

CEMENT PLASTER (STUCCO)

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials and installation of the exterior stucco finish. It is the intent of the new stucco finish to match existing finishes where installed.

1.02 SUBMITTALS

A. Submit product data including manufacturer's literature demonstrating compliance with these specifications.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   1. FBC, Florida Building Code.
   2. Portland Cement Plastering Standards

B. Use skilled workmen who are trained and experienced and who are familiar with the installation of the products specified herein.

PART 2 - MATERIALS

2.01 PLASTER MATERIALS.

A. Portland cement shall conform to ASTM C150, Type I or IA.

B. Lime shall be special finishing hydrated lime conforming to ASTM C206, Type S.

C. Sand shall be clean, natural and free from soluble salts and organic matter, and shall comply with ASTM C35 and when dry shall pass No. 4 sieve.

D. Fiber shall be pure manilla, glass or synthetic fiber, good quality ½ inch to 2 inches in length, free from grease, oil, dirt and other impurities. No asbestos shall be used.

E. Water shall be clean, fresh potable water.

F. Bonding agent shall be Acryl 60 by Harris Specialty Chemicals, Inc.

2.02 STUCCO ACCESSORIES

A. Stucco accessories shall be produced from weather proof PVC as manufactured by Vinyl Tech Accessories Plastic Components, Inc.

B. Corner beads shall be No. 1.

C. Casing beads shall be No. 10.

D. Stucco reveal shall be 708-75.

E. Stucco reveal cross intersection shall be PRC-75.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas where the cement plaster (stucco) will be installed and bring any unsatisfactory conditions to the attention of the Contractor. Do not proceed with installation until the unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Cement plaster (stucco) shall be 3 coat work on CMU or concrete with a minimum thickness of ¾ inch. The three coats shall be scratch coat, brown coat and finish coat.

B. Apply scratch coat in a 3/8 inch minimum thickness with sufficient pressure to force it through and completely imbed metal lath or to form a good bond on masonry, and then scratch to roughen surface.

C. Apply brown coat over scratch coat in a ¼ inch minimum thickness with sufficient pressure to form a good bond, rodded level and left rough.

D. Apply finish coat over brown coat in a 1/8 inch minimum thickness. Float finish to a true, even surface and as required to produce a fine texture. Finish shall be sand finish.

E. Moisture protection and curing. Dampen previous coats that have dried out prior to time for applications of next coat. Dampen with water as required for uniform suction.

3.03 CLEANUP

A. Clean up any loose material upon completion of installation and dispose of in designated containers or off site.

END OF SECTION

SECTION 09900

PAINTING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This section covers field applied protective coatings, including surface preparation, protection of surfaces, inspection, and other appurtenant work for surfaces listed herein and not otherwise excluded. All surfaces described, whether new or existing, shall be included within the scope of this Section.

B. The work includes painting and finishing of interior and exterior exposed items and surfaces such as ceilings, walls, floors, miscellaneous metal, doors, frames, transoms, roof fans, construction signs, guardrails, posts, pipes, fittings, valves, equipment, and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. Minor items omitted in the schedule of work shall be included in the work of this section where within the general intent of the specifications as stated herein. The following major items of the Project shall be coated:
   1. Interior of cast-in-place concrete, concrete block walls, concrete ceilings and concrete floors; and exterior concrete block and stucco walls. This shall include
      a. the interior and exterior of the sodium hypochlorite and fluoride buildings,
      b. the complete exterior walls of the Cypress Walk WSF High Service Pump Building excluding doors, windows and louvers.
   2. Exposed ferrous surfaces of equipment, pumps, motors, tanks and ferrous or galvanized metal fittings and accessories.
   3. Exposed surfaces of PVC components of piping, fittings, valves, electrical conduit and equipment.
   4. Exposed exterior surfaces of all metallic piping, fittings and valves located on the interior and exterior of buildings and structures. This shall include new piping, fittings and valves for the Project.
   5. Embedded aluminum or aluminum in contact with dissimilar metals or in contact with corrosive atmospheres.

C. The following surfaces or items are not required to be field painted:
   1. Portions of metal other than aluminum embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces which shall be painted before erection. Aluminum to be embedded in or in contact with concrete shall be coated to prevent electrolysis.
   2. Brass, bronze, and aluminum other than exposed tubing.
   3. Piping buried in the ground or embedded in concrete.
   4. Ducts, pipes and other miscellaneous items covered with insulation or plastic coated.
   5. Stainless steel angles, tube, pipe, etc. unless specified or shown to be coated.

6. Fiberglass.
7. Aluminum or fiberglass handrails, walkways, toeboards, windows, louvers, grating, checker plate, hatches, and stairways.
8. Finish hardware.
9. Products with polished chrome, aluminum, nickel or stainless steel finish.
10. Plastic switch plates and receptacle plates.
11. Electrical switchgear and motor control centers.
12. Any code-requiring labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.02 SUBMITTALS

A. Submit to the Engineer as provided in the General Conditions and Section 01300, shop drawings, manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness.

B. Submit documentation of paint contractor’s and coating applicator’s experience applying the specified coatings.

C. When the proposed products will be in contact with treated or raw water in potable water treatment facilities, Contractor shall submit certifications that the proposed systems are in compliance with ANSI/NSF 61.

D. Schedule of Painting Operations:
   1. Contractor shall submit for approval a complete Schedule of Painting Operations within 90 days after the Notice to Proceed. This Schedule is imperative so that the various fabricators may be notified of the proper shop prime coat to apply. It shall be the Contractor's responsibility to properly notify and coordinate the fabricators' surface preparation and painting operations with these Specifications.
   2. This Schedule shall include for each surface to be painted, the brand name, the volume solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness, and color charts. When the Schedule has been approved, the Contractor shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gages may be utilized by the Owner’s representative to verify the proper application while Work is in progress.

E. Color Samples: Manufacturer's standard color charts for color selection by Owner.

F. Samples-Painting:
   1. Paint colors will be selected by Owner. Compliance with all other requirements is the exclusive responsibility of the Contractor.
   2. Samples of each finish and color shall be submitted to the Owner or Engineer for approval before any work is started.

3. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where three (3) coat work is specified, the sample shall be divided into three (3) areas:
    a. One (1) showing the application of one (1) coat only.
    b. One (1) showing the application of two (2) coats.
    c. One (1) showing the application of all three (3) coats.
4. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.
5. For piping, valves, equipment and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish and general characteristics.
6. Rejected samples shall be resubmitted until approved.

1.03 DELIVERY, HANDLING AND STORAGE

A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label in accordance with Section 01600: Materials and Equipment. Provide labels on each container with the following information:
    1. Name or title of material.
    2. Fed. Spec. number if applicable.
    3. Manufacturer's stock number, date of manufacture and expiration date (shelf life).
    4. Manufacturer's formula or specification number.
    5. Manufacturer's batch number.
    6. Manufacturer's name.
    7. Generic type.
    8. Contents by volume, for major pigment and vehicle constituents.
    9. Application instructions: thinning, ambient conditions, etc.
    10. Color name and number.

B. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.

C. Material Safety Data Sheets shall be kept on-site and made readily available for all personnel.

D. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers. Containers shall be kept sealed and ready for use. All materials shall be stored in a cool, dry area out of the direct sunlight and away from any ignition source. Contractor shall refer to the manufacturer's literature and material safety data sheets for additional storage requirements.

E. Storage of paint materials and related equipment shall comply with the requirements of pertinent codes and fire regulations. In addition, all safety precautions noted on the manufacturer's Material Safety Data Sheets and other literature shall be strictly followed. Proper containers outside of buildings shall be provided by the Contractor and used for painting wastes. No plumbing fixtures shall be used for this purpose.

1.04 QUALITY ASSURANCE

A. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Provide undercoat paint produced by the same manufacturer as the finish coats. Undercoat and finish coat paints shall be compatible. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

C. Painting shall be accomplished by experienced painters specializing in industrial painting familiar with all aspects of surface preparations and applications required for this project. The paint contractor shall have a minimum of 10 years experience in industrical painting . The applicator of System 3 shall have a minimum of five (5) years documented experience in the application of of epoxy-based floor coatings to concrete floors.

D. All work shall be proved to be in first class condition and constructed in accordance with the Drawings and specifications. All defects disclosed by tests and inspections shall be remedied immediately by the Contractor at no expense to the Owner.

E. Holiday Testing: Each coat shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62.

1.05 WARRANTY AND GUARANTEES

A. All paint and coatings work performed under these specifications shall be guaranteed by the coatings applicator for 100 percent of the total coated area for both materials and labor against failures during the warranty period.

B. Failure under this warranty shall include flaking, peeling, or delaminating of the coating due to aging, chemical attack, or poor workmanship; but it shall not include areas which have been damaged by unusual chemical, thermal, or mechanical abuse.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All paint shall be manufactured by one of the suppliers listed herein and shall be their highest grade of paint.

B. The following coating systems list a product by name to establish a standard of quality; other products of the same generic types may be submitted to the Engineer for approval. When other than the specified coating system is proposed, the Contractor shall submit on a typewritten list giving the proposed coatings, brand, trade name, generic type and catalog number of the proposed system for the Engineer's approval. Contractor shall submit sufficient data substantiated by certified tests, conducted at no expense to the Owner, to demonstrate its equality to the paint(s) named. Provide list and data to the Engineer for approval within 30 days after the Notice to Proceed. The type and number of tests performed shall be subject to the Engineer's approval.

C. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint. Shop paint shall be of the same type and manufacture as used for field painting by the Contractor.

D. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil.

E. Rags shall be clean painter's rags, completely sterilized.

2.02 COLOR CODING FOR PIPES AND EQUIPMENT

A. Color coding shall consist of color code painting and identification of all exposed conduits, trough items and pipelines for the transport of gases, liquid and semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to be whole functional mechanical pipe and electrical conduit system. See Section 09905 Piping and Equipment Identification System.

B. All hangers and pipe support floor stands shall be painted. The system shall be painted up to but not including the flanges attached to the mechanical equipment or the flexible conduit connected to electrical motors. Colors shall be designated by Owner.

C. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including, the fixed flanges or connections on the equipment.

D. The color code establishes, defines and assigns a definite color for each category of pipe. Pipelines that are not listed on the Schedule of Color Code Paints shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.

2.03 FABRICATED EQUIPMENT

A. Unless otherwise indicated all fabricated equipment shall be shop primed and field finished.

B. All items to be shop primed shall be thoroughly cleaned of all loose material prior to priming. If, in the opinion of the Engineer, any prime coating has been improperly applied or if material contrary to these Specifications has been used, that coating shall be removed by sandblasting to white metal and reprimed in accordance with these Specifications.

C. All shop prime coats shall be of the correct materials and applied in accordance with these Specifications. The Contractor shall remove any prime coats not in accordance with these Specifications by sandblasting and apply the specified prime coat at no additional cost to the Owner.

D. Shop primed surfaces shall be cleaned thoroughly and retouched with the specified primer before the application of successive paint coats in the field. Touch areas on ferrous metal surfaces shall be given spot sand blast to SSPCSP-10 and reprime.

E. Contractor shall be responsible for taking whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.

F. If, in the opinion of the Engineer, a shop finish coat does not give the protection quality of other Work of similar nature the Contractor shall apply the coat or coats of paint as directed by the Engineer to accomplish the desired protection quality.

G. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned by the Contractor.

2.04 COATING SYSTEMS

A. System 1 – Interior Concrete and Masonry, Non-Immersion. Excludes all floors and slabs, and the bottom five feet of walls within the chemical buildings and pump rooms. Examples of this classification include the following surfaces:
   1. Examples of this classification include the following surfaces:
      a. Masonry and plaster.
      b. Concrete block walls.
      c. Concrete walls, columns and supports.
      d. Concrete ceilings and beams.
   2. Surface Preparation: Allow new concrete and mortar to cure 28 days. Level protrusions and mortar spatter.
   3. Filler: One coat of one of the following, or equal:
      a. Tnemec Series 215 Surfacing Epoxy at 52 square feet per mixed gallon.
   4. Finish: Two (2) coats of one of the following, or equal:
      a. Tnemec Series N69 Hi-Build Epoxoline II at 5.0 mils dry thickness per coat.

B. System 2 – Exposed Concrete and Masonry, Non-Immersion.
   1. Examples of this classification include the following surfaces:
      a. Exterior, aboveground concrete and concrete block wall surfaces of new and existing structures.
   2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:
      a. New concrete and masonry surfaces shall be prepared by filling cracks, voids and other surface imperfections, removing mortar droppings, cleaning and high pressure water blasting.
      b. Existing concrete surfaces shall be prepared by high pressure water blasting or abrasive blast cleaning to remove existing deteriorated or disbonded coatings as required for adhesion of the new coating system.
   3. Prime Coat for New Concrete Structures: Cement base waterproofing:
      a. Thoro Systems Thoroseal: One (1) coat, 2 lbs per square yard.
   4. Prime Coat for New Masonry Structures: Single-component cementitious acrylic masonry block filler:
      a. Tnemec Series 130-6602 Envirofill at 80-100 sf/gal.
   5. Prime Coat for Previously Coated Structures: Two component waterborne epoxy primer.
      a. Tnemec Series 151 Elasto-grip at 300 sf/gal.
   6. Finish Coats: High quality elastometric coating.
      a. Tnemec Series 156 Envirofill; two coats at 5.0 mils DFT per coat.
   7. Total minimum system finish coating thickness shall be 10.0 mils DFT over the primer or sealer.

C. System 3 – Concrete Floors and Masonry Walls, Chemical Resistant.
   1. Examples of this classification include the following surfaces:
      a. Concrete and masonry surfaces that are subject to splashing, spillage and fumes of chemicals.
      b. Concrete floors and slabs, equipment pads, sumps, and bottom 5 feet of concrete columns and masonry walls in hypochlorite and fluoride buildings.
   2. Applicator shall have a minimum of five (5) years documented experience in the application of epoxy-based floor coatings to concrete floors.
   3. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:
      a. New concrete and masonry shall be cured for at least 28 days before lining is applied. New masonry surfaces shall be prepared by filling cracks, voids and other surface imperfections using a epoxy concrete filler, removing mortar droppings, cleaning and high pressure water blasting.
      b. Concrete surfaces, including those with bug holes less than 1 inch [25 mm] in any dimension, shall be prepared using an epoxy concrete filler or as recommended by the material manufacturer and acceptable to Engineer.

c. Contractor shall repair all concrete surfaces that have spalls, voids, and cracks and shall remove all fins and other surface projections to produce a flush surface for application of the coating system. Grind concrete at edges of metal drains, troughs, and sumps to accommodate application of new coatings. Remove all loose old coatings, and scarify all surfaces by abrasive blasting, mechanical grinding or blastrac cleaning. Feather edges of old sound coatings to blend with the new coating. Ensure all surfaces are clean, dry and abraded prior to application of any repair or coating materials.
d. All concrete surfaces to be lined shall be cleaned in accordance with ASTM D4258 and abrasive blasted in accordance with ASTM D4259. Before the lining is applied, the surfaces shall be thoroughly washed or cleaned by air blasting to remove all dust and residue.
e. Follow materials manufacturer's written instructions. All concrete and masonry surfaces shall be ready to receive the lining/coatings as determined by the materials manufacturer and accepted by the Engineer.

4. Repair all voids, spalls and areas of lost concrete. Fill control joints.
   a. Florock Florogel Epoxy Patch.
5. Prime Coat:
   a. Crawford Laboratories Floropoxy 4700 Epoxy Primer. One application at 8 mils. Squeegee applied, backroll with nap roller at manufacturer's recommend spread rate.
6. Midcoat:
   a. Crawford Laboratories Novolac Epoxy. Squeegee applied, backroll with nap roller at manufacturer's recommend spread rate.
7. Finish Coat:
   a. Crawford Laboratories Novolac Epoxy. Squeegee applied, backroll with nap roller at manufacturer's recommend spread rate.

D. System 3 – Metals, Immersion (Interior and Exterior) and Non- Immersion (Interior)
1. Consist of interior and exterior metal surfaces (immersion) and interior metal surfaces that do not come in direct contact with water or corrosive atmospheres.
2. Examples of this classification include the following surfaces:
   a. Pumps, motors, equipment and appurtenances.
   b. Aboveground piping, fittings, valves and metal electrical conduit.
   c. Miscellaneous steel plates, shapes, hardware, etc.
   d. Galvanized steel surfaces.
   e. Other surfaces obviously requiring field coating or as specified to be field coated in Division 11 or in Section 09905: Piping and Equipment Identification Systems.

3. Surface Preparation: As specified in Paragraph 3.02 herein and, in addition, the following:
    a. Non-immersion metals shall be abrasive blast cleaned to SSPC-SP6. Immersion metals shall be abrasive blast cleaned to SSPC-SP10.
    b. All bare metals or areas that were shop primed that have been damaged shall be abrasive blast cleaned to the appropriate, commercial blast cleaning standards.
    c. Shop primed items, stored on site for a prolonged period prior to coating, shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation may include brush-off abrasive blasting or spot blasting to the appropriate, commercial blast cleaning standards, for areas where the primer has been damaged and bare metal is showing.
    d. Non-ferrous metals shall be degreased and cleaned by washing with a water based dispersant. Rinse thoroughly with clean water after cleaning.
4. System 3 Coating System (Immersion)
    a. Prime Coat for Ferrous and Non-Ferrous Metals: NSF Part 61 approved, two-part epoxy polyamide primer. Tnemec Series 140-1255 (Beige) Pota-Pox Plus at 4.0 mils DFT.
    b. Finish Coat for Non-Ferrous Metals: NSF Part 61 approved epoxy coating. Tnemec Series 140-WH02 (Tank White) Pota-Pox Plus at 4.0 mils DFT.
    c. Finish Coats for Ferrous Metal: NSF Part 61 approved, two component, cross linked epoxy. Tnemec Series 140 Pota-Pox Plus: Two coats at 5.0 mils DFT per coat.
    d. Total minimum system finish coating thickness shall be 14.0 mils DFT for ferrous metals and 8.0 mils DFT for non-ferrous metals.
5. System 3 Coating System (Non-Immersion)
    a. Prime Coat for Ferrous and Non-Ferrous Metals: Two component, cross-linked epoxy primer. Tnemec Series 69 Hi-Build Epoxoline II at 4 mils DFT.
    b. Finish Coat for Non-Ferrous Metals: Two-part epoxy. Tnemec Series 69 Hi-Build Epoxoline II at 3.0 mils DFT.
    c. Finish Coat for Ferrous Metal: Two component, cross-linked epoxy. Tnemec Series 69 Hi-Build Epoxoline II at 5.0 mils DFT.
    d. Total minimum system finish coating thickness shall be 9 mils DFT for ferrous metals and 7 mils DFT for non-ferrous metals.

E. System 4 Exposures – Plastic Piping, Valves, Fittings and Conduit, Interior and Exterior
1. Class 7 exposures consist of PVC or fiberglass piping and structural shapes or electrical systems requiring color coding, and for protection of exposed, exterior plastic components from the elements, and shall include the following:
    a. PVC and fiberglass piping, fittings, valves and electrical conduits requiring color coding in accordance with Section 09905: Piping and Equipment Identification System.
    b. Exposed exterior plastic piping, valve and fitting components subject to UV degradation and weathering by the elements.

2. Surface Preparation: As specified in Paragraph 3.02 herein, including cleaning and washing with detergent to remove all dirt and foreign material, and light surface abrasion using medium grade sandpaper. Remove dust, dirt and debris with clean rags prior to coating.
3. System 4 Coating System:
    a. Prime Coat: Two component epoxy. Tnemec Series 66 Hi-Build Epoxoline at 3.0 mils DFT.
    b. Finish Coats for exterior surfaces: Tnemec Series 73 Endurashield at 3.0 mils DFT.
    c. Finish coat for interior exposure: Tnemec Series 66 Hi-Build Epoxoline at 3.0 mils DFT.
    d. Total minimum system finish coating thickness shall be 6 mils DFT.

F. System 5 Exposures – Aluminum
1. System 5 exposures consist of aluminum surfaces embedded or in contact with concrete, mortar or plaster, or aluminum in contact with dissimilar metals which may cause corrosion due to electrolysis, and shall include the following:
    a. Aluminum surfaces in contact with concrete, mortar or plaster, such as hatch cover frames, stair stringers, portions of grating and frames, floor plate and frames, etc.
    b. Aluminum surfaces in contact with dissimilar metals which may cause corrosion due to electrolysis.
2. Surface Preparation: As specified in Paragraph 3.02 herein, including solvent cleaning in accordance with SSPC-SP1 standards for solvent cleaning and scarification.
3. System 5 Coating System:
    a. Prime Coat: Two component polyamide epoxy. Tnemec Series 66 Hi-Build Epoxoline at 3.0 mils DFT.
    b. Finish Coats for Aluminum Exposed to View: Two-component, high build, acrylic urethane. Tnemec Series 73 Endurashield at 3.0 mils DFT.
    c. Finish Coat for Aluminum Not Exposed to View: Polyamide cured coal tar epoxy. Tnemec Series 46H-413 Hi-Build Tneme-Tar applied at 16.0 mils DFT.
    d. Total minimum system finish coating thickness shall be 19.0 mils DFT for areas not exposed to view or 6.0 mils for areas exposed.

G. System 6 Exposures – Metals Exterior Exposed
1. System 6 exposures consist of exterior metal surfaces exposed to the weather and environment.
    a. Pumps, motors, equipment, and appurtenances
    b. Above ground piping, fittings, valves, and metal conduit
    c. Miscellaneous metal surfaces
    d. Ladders, stairways, structural steel
    e. Roof mounted equipment, hatches, fans, etc.
    f. Galvanized and non-ferrous metal surfaces
    g. Other surfaces obviously requiring field painting

2. Surface Preparation: As specified in paragraph 3.02 herein and, in addition, the following:
    a. All bare metals or areas that were shop primed that have been damaged shall be abrasive blast cleaned to SSPC-SP6, commercial blast cleaning standards.
    b. Shop primed items, stored on site for a prolonged period prior to coating, shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation may include brush-off abrasive blasting or spot blasting to SSPC-SP6, commercial blast cleaning standards, for areas where the primer has been damaged and bare metal is showing.
    c. Non-ferrous metals shall be degreased and cleaned by washing with a water based dispersant such as Carboline Surface Cleaner #3. Rinse thoroughly with clean water after cleaning.
3. System 6 Coating System
    a. Prime coat for ferrous and non-ferrous metal: Two part epoxy primer. Tnemec Series 69 Hi-Build Epoxoline II at 4.0 mils DFT.
    b. Intermediate coat for ferrous metal: Two part epoxy. Tnemec Series 69 Hi-Build Epoxoline at 3.0 mils DFT.
    c. Finish coat for ferrous and non-ferrous metal: High Build Acrylic Polyurethane. Tnemec Series 73 Endura-Shield at 3.0 mils DFT.
    d. Total minimum system finish shall be 7.0 mils for non-ferrous metal and 10.0 mils for ferrous metal surfaces.

PART 3 – EXECUTION

3.01 SHOP PAINTING

A. Surface Preparation – All ferrous metal to be primed in the shop shall have all rust, dust and scale, as well as all other foreign substances, removed by sandblasting or pickling in accordance with SSPC-SP5 or SP8, respectively. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Under no circumstances will cleaned metal be allowed to sit overnight before priming, or pretreatment and priming. All nonferrous metals shall be solvent cleaned prior to the application of primer. In addition, galvanized surfaces which are to be topcoated shall first be degreased then primed. All non-ferrous metal surfaces shall also be scarified prior to topcoating.

B. Materials Preparation:
    1. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt and other foreign materials.
    2. No thinners shall be used except those specifically mentioned and only in such quantity as directed by the manufacturer in his instructions. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or cleanup solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

C. Applications:
   1. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship. Coating systems shall be as specified herein.
   2. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.
   3. All paint and coatings materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.
   4. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.
   5. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness.
   6. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.
   7. Equipment manufacturer or supplier shall provide touch-up paint for items with shop applied finish coats.
   8. Where specified in the individual sections, primer coat(s) shall be applied in the shop by the equipment manufacturer. The shop coats shall be as specified and shall be compatible with the field coat or coats.

D. Certification: The Contractor shall obtain from the equipment manufacturer or supplier, prior to shipment of equipment, a written certification that surface preparation, coating brand, material, DFT and application method complied with this Section.

3.02 PREPARATION OF SURFACES

A. All surfaces to be painted shall be prepared as specified herein and shall be dry and clean before painting. Special care shall be given to thoroughly clean interior concrete and concrete block surfaces to receive polyamide cured equipment of all marks before application of finish. Review all completed surface preparation with Owner’s representative prior ro applying coatings.

B. All metal welds, blisters, etc., shall be ground and sanded smooth in accordance with SSPC-SP-3 or in difficult and otherwise inaccessible areas by hand cleaning in accordance with SSPC-SP-2. All weld spatter shall be removed and all fabricated metal with sharp edges shall be ground smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting. All rust, loose scale, oil, grease and dirt shall be removed by use of approved solvents, wire brushing or sanding.

C. All plastic pipe surfaces shall have surfaces lightly sanded before painting.

D. Exposed Pipe: Bituminous coated pipe shall not be used in exposed locations. Pipe which shall be exposed after project completion shall be primed in accordance with the requirements herein. Any bituminous coated pipe which is inadvertently installed in exposed locations shall be sandblasted clean before priming and painting. After installation all exterior, epoxied flanged joints shall have the gap between adjoining flanges sealed with a single component Thiokol caulking to prevent rust stains. Apply coating behind clamps and brackets.

E. Primed or Coated Surfaces and Nonferrous Surfaces: All coated surfaces shall be cleaned prior to application of successive coats. All nonferrous metals not to be coated shall be cleaned. This cleaning shall be done in accordance with SSPC-SP-1, Solvent Cleaning.

F. Shop-Finished Surfaces: All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged areas immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be "Hand Cleaned" and then touched up with the same materials as the shop coat. All shop coated surfaces which are faded, discolored, or which require more than minor touch-up in the opinion of the Engineer shall be repainted. Cut edges of galvanized sheets and exposed threads and cut ends of galvanized piping, electrical conduit, and metal pipe sleeves, not to be finished painted, shall be "Solvent Cleaned" and prepared in accordance with SSPC-SP2 or SSPC-SP3 guidlelines and then primed with a zinc phosphate metal primer such as Carboline Carbocoat 150 Universal Primer.

G. Galvanized and Zinc-Copper Alloy Surfaces: These surfaces to be painted shall be "Solvent Cleaned" and treated as hereinafter specified. Such surfaces not to be painted shall be "Solvent Cleaned".

H. Aluminum embedded or in contact with concrete shall be prepared in accordance with SSPC-SP7 guidelines and must be painted with one coat of aluminum epoxy mastic such as Carboline Carbomastic 15 .

I. Ductile Iron: Reference the NAPF 500-03 surface preparation standard for ductile iron pipe and fittings in exposed locations receiving special external coating and/or special internal linings for applicable surface preparation guidelines.

3.03 WORKMANSHIP

A. General:
   1. Primer (spot) and paint used for a particular surface shall, in general, be as scheduled for that type of new surface. Confirm with the paint manufacturer that the paint proposed for a particular re-paint condition will be compatible with the existing painted surface. Sample re-painted areas on the actual site will be required to insure this compatibility. Finished repainted areas shall be covered by the same guarantee specified for remainder of Work.

2. At the request of the Engineer, samples of the finished Work prepared in strict accordance with these Specifications shall be furnished and all painting shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the Engineer where standard chart colors are not satisfactory.
3. Protection of equipment, fittings and accessories shall be provided throughout the painting operations. Mask all machinery name plates and all machined parts not receiving a paint finish. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other Work from all damage during the operation and until the finished job is accepted.
4. On metal surfaces apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry mil thickness required. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall cover a greater area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat(s). On masonry, application rates will vary according to surface texture, however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.
5. All safety equipment shall be painted in accordance with OSHA Standards as approved.
6. Paints shall be mixed in proper containers of adequate capacity. All paints shall be thoroughly stirred before use and shall be kept stirred while using. No unauthorized thinners or other materials shall be added to any paint.
7. Only skilled painters shall be used on the Work and specialists shall be employed where required.
8. Work shall be done in a safe and workmanlike manner.

B. Field Priming:
1. Steel members, metal castings, mechanical and electrical equipment and other metals which are shop primed before delivery at the site will not require a prime coat on the job. All piping and other bare metals to be painted shall receive one coat of primer before exposure to the weather, and this prime coat shall be the first coat as specified in the painting schedule.
2. Equipment which is customarily shipped with a baked-on enamel finish or with a standard factory finish shall not be field painted unless the finish has been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged, or where the shop coats or coats of paint have deteriorated, shall be properly cleaned and retouched before any successive painting is done on them in the field. All such field painting shall match as nearly as possible the original finish.

C. Field Painting:
   1. All painting at the site shall be designated as Field Painting.
   2. All paint shall be at room temperature before applying, and no painting shall be done when the temperature is below 50 degrees F., in dust-laden air, when rain or snow is falling, or until all traces of moisture have completely disappeared from the surface to be painted.
   3. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.
   4. Finish surfaces shall not show brush marks or other irregularities. Undercoats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted and all exterior trim shall be back-primed before installation.
   5. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. All exterior concrete and masonry paint shall be performed at one continuous manner structure by structure. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.
   6. All materials shall be brush painted unless spray painting is specifically approved by the Engineer.
   7. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be scraped off and repainted in accordance with the Engineer's directions.
   8. Before final acceptance of the Work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.
   9. The aluminum Work noted on the Drawings or in the Painting Schedule except all structural walkways, supports, railings, toeboards, grating and checkered plate shall be field painted.
   10. Any pipe scheduled to be painted and having received a coating of tar or asphalt-compound shall be painted with two coats or equal before successive coats are applied per the schedule.

3.04 CLEANUP

A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or Work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave Work "broom clean" unless more exactly specified.

B. Upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the Work ready for inspection.

END OF SECTION

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SECTION 09905

PIPING, VALVE, AND EQUIPMENT IDENTIFICATION SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of providing an identification system for piping systems and related equipment.

B. Related Work Described Elsewhere:
   1. Submittals: Section 01300.
   2. Painting: Section 09900.
   3. Equipment: Division 11
   4. Mechanical: Division 15.
   5. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Standards: ANSI Standard A13.1, Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data in accordance with Section 01300.

B. Schedules:
   1. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.
   2. Provide a complete list of materials to be furnished and surfaces on which they will be used.

C. Samples:
   1. Provide a sample of each type valve of tag supplied.
   2. Provide a sample of each type of identification tape supplied.
   3. Provide manufacturer's color charts for color selection by Engineer.

1.04 PRODUCTS DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.

B. Storage of Materials:
   1. Store only acceptable project materials on project site.
   2. Store in suitable location.

3. Restrict storage to paint materials and related equipment.
4. Comply with health and fire regulations.

1.05 JOB CONDITIONS

A. Environmental Requirements:
   1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
   2. Do not apply finish in areas where dust is being generated.

B. Protection: Cover or otherwise protect finished work of other trades and surfaces not to be painted.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials for painting shall conform to the requirements of Section 09900: Painting.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

C. Aboveground piping shall be identified by self-adhesive pipe markers equal to those manufactured by W. H. Brady Company or approved equal.
   1. Markers shall be of wording and color as shown in Table 09905-A.
   2. Lettering shall be:
      a. 2¼-inches high for pipes 3 inches diameter and larger.
      b. 1 1/8-inches high for pipes less than 3 inches diameter.
   3. Flow arrows shall be:
      a. 2¼-inches by 6 inches for pipes 3 inches diameter and larger.
      b. 1 1/8-inches by 3 inches for pipes less than 3 inches diameter.

D. Buried piping shall be identified by identification tape installed over the centerline of the pipelines.
   1. Identification Tape for Steel or Iron Pipe: Identification tape shall be manufactured of inert polyethylene film and shall have a minimum thickness of 6 mils. Tape width shall be 6 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be Terra Tape Standard, or approved equal.
   2. Identification Tape for Plastic or Non-Magnetic Pipe: Identification tape shall be manufactured of reinforced polyethylene film with a minimum overall thickness of 6 mils and shall have a 0.30 mil thick magnetic metallic foil core. Tape width shall be 3 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be TerraTape Sentry Line, or approved equal.

3. Tape background colors and imprints shall be as follows:

Imprint	Background Color
"Caution Sewer Line Buried Below"	Green
"Caution Electrical Line Buried Below"	Red
"Caution Water Line Buried Below"	Blue
"Caution Telephone Line Buried Below"	Orange
"Caution Reuse Line Buried Below"	Purple
"Caution Compressed Air Line Buried Below"	Dark Green
"Caution Chlorine Line Buried Below"	Yellow
"Caution Fluoride Line Buried Below"	Orange

4. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, TX; Allen Systems, Inc., Wheaton, IL; or approved equal.

E. Locating Wire:
   1. All buried pipe shall be installed with insulated locating wiring capable of detection by a cable locator and shall be wrapped with nylon straps to top centerline of the pipe.
   2. Locating wire shall be 10 gauge solid copper, continuous with no splices, and be color-coded to match the utility installed.

F. Aboveground Valve Identifications: A coded and numbered tag attached with brass chain and/or brass "S" hooks shall be provided on all valves.
   1. Tag Types: Tags for valves on pipe shall be brass or anodized aluminum. Colors for aluminum tags shall, where possible, match the color code of the pipe line on which it is installed. Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.
   2. Coding: In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the valve service and number. All color and letter coding shall be approved by the Engineer. Valve service shall either be as listed in Table 09905-A, or by equipment abbreviation if associated with a particular piece of equipment. Valve numbering, if required, shall be as approved by the Engineer and/or Owner.

G. Buried valves shall have valve boxes protected by a concrete pad. The concrete pad for the valve box cover shall have a 3-inch diameter, bronze or stainless steel disc embedded in the surface as shown on the Drawings. The disc shall have the following information neatly stamped on it:
   1. Size of valve, inches.
   2. Type of valve:
      a. GV – Gate Valve
      b. BFV – Butterfly Valve
      c. PV – Plug Valve
   3. Valve Services – See Table 09905-A for abbreviations.
   4. Direction to open and number of turns to fully open.

PART 3 – EXECUTION

3.01 COLOR CODING FOR PIPES AND EQUIPMENT

A. Piping color codes and code labels for pipe identification shall conform to Table 09905-A.

B. General Notes and Guidelines:
   1. Pipelines, equipment, or other items that are not listed here shall be assigned a color by the Owner and shall be treated as an integral part of the Contract.
   2. Color coding shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit system.
   3. All moving parts, drive assemblies, and covers for moving parts that are potential hazards shall be Safety Orange.
   4. All safety equipment shall be painted in accordance with OSHA Standards.
   5. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to, but not including, the flanges attached to pumps and mechanical equipment assigned another color.
   6. All pipe hangers and pipe supports shall be painted, unless specified otherwise due to material of construction.

C. All pipe hangers, pipe supports, and accessories shall be painted to match their piping. The system shall be painted up to, but not including, the face of flanges or the flexible conduit connected to electrical equipment. Structural members used solely for pipe hangers or supports shall be painted to match their piping. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated in accordance with Section 09900.

D. All systems that are an integral part of the equipment, that is, originating from the equipment and returning to the same piece of equipment, shall be painted between and up to, but not including, the face of flanges or connections on the equipment.

E. All insulated surfaces, unless otherwise specified, shall be given one (1) coat of sizing, one (1) prime coat, and one (1) finish coat.

F. System code lettering and arrows shall conform to the requirements of ANSI A 13.1 marked on piping as follows:
   1. Legends shall be of the following color for the respective pipe color:

Key to Classification of Predominant Colors For Piping		Color of Letters, if not Otherwise Specified
(F) Fire Protection:	Red	White
(D) Dangerous:	Yellow	Black
	Orange	Black
(S) Safe:	Green	Black
	White	Black
	Black	White
	Light Gray	Black
	Dark Gray	White
	Aluminum	Black
(P) Protective:	Blue	White

   2. All piping containing or transporting corrosive or hazardous chemicals shall be identified with labels every 10 feet and with at least two (2) labels in each room. Otherwise, markers shall be placed no more than 20 feet apart with at least one (1) marker on every straight run and additional markers at turns and where pipes pass through walls.
   3. An arrow indicating direction of flow shall be placed adjacent to each marker.

3.02 FABRICATED EQUIPMENT

A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished. See Section 09900: Painting.

B. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage.

C. Where specified in other Sections of these Specifications for mechanical equipment, the Contractor shall apply field coats of paint in accordance with Section 09900. If the shop finish coating is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with Section 09900 and this Section.

D. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned. Equipment contaminated by grit in critical areas, such as bearings, gears, seals, etc., shall be replaced at no cost to the Owner.

3.03 INSTALLATION OF IDENTIFICATION TAPE

A. Identification tape shall be installed for all buried pipelines and conduits in accordance with the manufacturer's installation instructions and as specified herein.

B. Identification tape for piping shall be installed at two (2) locations:
   1. One (1) foot below finished grade along centerline of pipe, and;
   2. Directly on top of the pipe.

TABLE 09905-A
COLOR CODES AND ABBREVIATIONS

Service	Mark	Conduit, Pipe, and Valve Color Code	Letter and Flow Arrow Color
Sodium Hypochlorite	C	Yellow	Black
Hydrofluorosilicic Acid	F	Light Blue with Red Band	Black
Drain	DR	Dark Gray	White
Water Main	WM	Dark Blue	White
Sample Line	SA	Gray	Black

1. Note: Yellow shall be the Tnemec Series 1028 (Gloss) – Canary Yellow (14YW). Dark Blue shall be Tnemec Series 1028 (Gloss) Safety Blue (12SF). The Owner will provide color selection for all other colors.

END OF SECTION

DIVISION 10
SPECIALTIES

SECTION 10400

SIGNAGE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior signage
   2. Plastic safety signs.
   3. Hazardous Chemical Storage signs for tanks and building.
   4. Safety Shower and Eyewash signs.

1.02 SUBMITTALS

A. Product data sheets for each item specified.

B. Samples:
   1. Interior room number and name signs.
   2. Color sample chart for each type of sign indicated.

C. Provide a comprehensive list of all room names and numbers for each building space as well as quantities and locations for all other signs specified.

1.03 QUALITY ASSURANCE

A. Each door to each occupied space shall have a room sign installed.

B. All room signage and life safety signage shall be in Braille per the Florida Building code, 423.14.

1.04 FLORIDA ACCESSIBILITY CODE FOR BUILDING CONSTRUCTION

A. Signage shall conform with the Accessibility Requirements Manual from the Florida Department of Community Affairs, Florida Board of Building Codes and Standards.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Interior identifying devices and exterior building letters shall be as manufactured by one of the following:
   1. Rick’s Quality Printing & Signs
   2. Vital Signs of Orlando, Inc.
   3. Sign Design of Florida, Inc.

4. Environmental Graphics, Inc.
5. Innerface Architectural Signage
6. Commercial Signs & Graphics
7. Signs Plus
8. APCO Graphics, Inc.
9. ASI Sign Systems
10. Best Sign Systems

B. Safety Signage: Provide signs similar to MySafetySign.com.

2.02 INTERIOR SIGNAGE

A. Basis of Design: IM System, RI-66-A by APCO.

B. General:
1. Graphic Process: Raised letters and Braille, formed as an integral part of the sign face.
2. Size: 6 inches by 6 inches with radius corners.
3. Mechanically fastened.
4. Colors: Letters and background colors as selected by Architect from manufacturer's standard colors.
5. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum.
6. Characters and backgrounds must be eggshell, matte, or other non-glazed surface.

C. Capacity signs for all rooms with a capacity of 49 persons or more.
1. Provide capacity signs reading "MAXIMUM CAPACITY."
2. Provide at least two signs per room.

D. Maximum Occupancy Signage: Signs reading "MAXIMUM OCCUPANCY xx."

E. Toilet Room Accessibility Signs: Provide one sign depicting International Men/Women Symbol at each accessible toilet room.

F. Interior Room Name and Number Signs: Layout of room name and number shall be as directed by the Architect.
1. Layout of room name and number shall be as directed by the Architect.

G. Storage Signs: Provide at electrical, mechanical, kiln room, and fire riser rooms to read NO STORAGE ALLOWED.

H. Evacuation signage:
   1. Provide evacuation signs indicating a graphic diagram of primary and secondary evacuation routes posted inside, adjacent to the primary exit door. Provide at all room with occupancy of 6 or greater.
   2. Colors: Black building plan on white background with evacuation route in red.

I. Safety Sign:
   1. Plastic sheet with printed message.
   2. Refer to Owner for exact text of each sign.
   3. Mounting: Tamperproof 316 stainless steel screws and bolts for substrate intended.

J. Hazardous Chemical Warning Signs:
   1. Door-mounted hazardous warning signs shall be provided for each door for chemical supply/feed room.
   2. Wall-mounted or post mounted warning signs shall be provided for each chemical or fuel fill station.
   3. Tank mounted warnings signs shall be provided for each chemical storage tank.
   4. Hazardous warning signs shall be diamond-shaped with four color quadrants conforming to NFPA 704. These signs shall be 10-inch square overall size and shall be equivalent to Seton Name Plate Co. “Metal-backed butyrate (BMB)”.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Mount interior signage with concealed mechanical fasteners recommended by manufacturer. Safety signage to be screwed at each corner.

C. Provide mounting and installation kits for mounting building letters.

D. Install interior signage in accordance with approved shop drawings, Accessibility Requirements Manual from the Florida Department of Community Affairs.

E. Secure Work true to line and level. Allow for building expansion.

F. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

G. Isolate incompatible material as necessary to prevent deterioration.

H. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the

particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

1. Mounting Height: Mount accessible signage at 60-inches above finished floor to the center line of the sign.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11241

CHEMICAL FEED SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. Furnish all labor, materials, equipment, piping and piping accessories, and incidentals required and install complete, ready for operation, and field test the chemical feed systems as shown on the Drawings and as specified herein.
   2. Piping shall be furnished and installed complete with all fitting, jointing materials, hangers, supports, anchors, and other necessary appurtenances.

B. Related Work Described Elsewhere:
   1. Section 02220: Excavating, Backfilling, and Compacting.
   2. Section 09900: Painting.
   3. Section 09905: Piping, Valve, and Equipment Identification System.
   4. Section 11245: Packaged Chemical Feed System
   5. Section 13219: Polyethylene Chemical Storage Tanks
   6. Process instrumentation and controls are included under Division 13.
   7. Mechanical piping, valves, pipe hangers, accessories, and appurtenances are included under Division 15.
   8. Electrical work is included under Division 16.

C. General Design:
   1. General:
      a. Each water supply facility (WSF) consists of a sodium hypochlorite feed system that includes two polyethylene bulk storage tanks and two metering pump skids (pre-disinfection and post-disinfection) located in the existing chlorine building/room. The WSFs also consist of a hydrofluorosilicic acid feed system that includes a polyethylene bulk storage tank, a polyethylene day tank and a metering pump skid located in the existing fluoride storage building/room. The existing sodium hypochlorite and hydrofluorosilicic acid storage and feed systems will be demolished prior to the installation of the proposed storage and feed equipment. Also, the Oak Meadows WSF and Cypress Walk WSF each have a sodium hydroxide feed system that is no longer in use and will be demolished as part of this contract.
      b. The chemical feed systems specified herein are intended to support the operation of the water supply facilities. The existing day tanks and bulk storage tanks shall be replaced with storage tanks as listed in the tank schedule in Section 13214 and as shown on Drawings. The existing chemical metering pump skids shall be replaced with new metering pump skids as listed in the pump schedule in Section 11245 and as shown on the Drawings.

2. Hydrofluorosilicic Acid Feed System:
    a. System Operations: Hydrofluorosilicic acid is added to the raw water prior to the ground storage tanks to augment the natural fluoride concentration to produce a finished water fluoride concentration of 0.8 mg/L. Hydrofluorosilicic acid, 23% concentration is delivered to the site in truckloads and stored in a double-wall polyethylene bulk storage tank. Hydrofluorosilicic acid is transferred into the day tank in the fluoride storage building by gravity from the bulk storage tank. The hydrofluorosilicic acid is fed by metering pumps which automatically adjust the dosage in proportion to the water flow rate.
    b. Outside system piping shall be laid with a minimum of 18 inches of cover below finished grade unless otherwise indicated on the Drawings. System piping shall be constructed with ½-inch Schedule 80 PVC inside a 2-inch PVC containment pipe chase. Pull boxes shall be installed every 50 feet and at any change in direction. There shall be no bends or deflection in the carrier or containment pipes.
3. Sodium Hypochlorite Feed System:
    a. System Operations: sodium hypochlorite is added directly to the ground storage tanks (pre-disinfection) and to the raw water following the ground storage tanks (post-disinfection) to provide disinfection. Sodium hypochlorite is delivered to the plant site in truckloads and stored in two double-wall polyethylene bulk storage tanks. The sodium hypochlorite is fed by metering pumps (supplied directly from the bulk storage tanks) that are automatically adjusted in proportion to the water flow rate.
    b. Outside system piping shall be laid with a minimum of 18 inches of cover below finished grade unless otherwise indicated on the Drawings. System piping shall be constructed with ¾-inch PE tubing inside a 2-inch PVC containment pipe chase. Pull boxes shall be installed every 50 feet and at any change in direction. There shall be no bends or deflection in the carrier or containment pipes. Also, the piping shall be sloped down from the tank outlet towards the pump skid inlet to allow gases to vent back to the tank.

1.02 QUALITY ASSURANCE

A. The chemical feed systems specified herein shall be supplied by equipment manufacturers having experience in the design and manufacture of equipment of similar size and capacity and shall present proof of successful operations involving each piece of equipment operating under similar conditions.

1.03 SUBMITTALS

A. Materials and Shop Drawings:
    1. Submit to the Engineer for approval, as provided in the Section 01300: Submittals, operating and maintenance manuals, systems piping and wiring diagrams, and other descriptive material for all equipment to be furnished under this Section. In addition to the information above, the submittals shall include at least the following items to demonstrate conformance of materials:

a. Letter of Certification from the National Sanitation Foundation International (NSF) stating compliance with Standard 61.
b. Letter from the Manufacturer verifying chemical compatibility of all products to be used in chemical feed systems.

2. Submit to the Engineer for approval: complete specifications, data, and catalog cuts or drawings for piping materials and appurtenances including, but not limited to the following:
   a. Expansion joints for PVC pipe.
   b. Flange gaskets.
   c. PVC chemical service pipe and fittings.
   d. Pipe sleeves.
   e. Pipe supports.
3. Contractor shall provide a SOP for the safe handling and repair of the fluoride and sodium hypochlorite systems.

B. Additional Information: in the event that it is impossible to conform to certain details of the specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

1.04 OPERATIONS AND MAINTENANCE DATA

A. Operating and Maintenance Instructions:
1. 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 operation and maintenance personnel unfamiliar with such equipment. The number and special requirements shall be as specified in Section 01300: Submittals.
2. A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided to instruct representatives of the Owner and the Engineer on proper operation and maintenance. With the Owner's permission, this work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3 – EXECUTION. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage, and handling of products shall be as specified in Section 01610: Delivery, Storage, and Handling.

B. Pipe and fittings shall be handled and stored in a manner that will ensure installation in sound, undamaged condition. Handling methods and equipment used shall prevent damage to the protective coating and shall include the use of end hooks, padded calipers, and nylon or similar fabric slings with spreader bars. Bare cables, chains, or metal bars shall not be used. Coated pipe shall be stored off the ground on wide padded skids. Whenever the storage period on the job exceeds 30 days, plastic coated pipe shall be covered or otherwise protected from exposure to sunlight.

1.06 WARRANTY AND GUARANTEES

A. Provide equipment (system) warranty per Section 01740: Warranties and Bonds and the individual sections of the Specifications..

PART 2 – PRODUCTS

2.01 GENERAL

A. These Specifications are intended to give a general description of what is required, but do not cover details of construction which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to include the furnishing, shop testing, delivery, installation, supervision, and field testing of all materials, equipment, and appurtenances for the chemical feed equipment as herein specified, whether specifically mentioned in these Specifications or not. Also included in these Specifications is the instruction of the regular operating personnel in the care, operation, and maintenance of all equipment.

B. All necessary accessory equipment and auxiliaries required for the proper functioning of the chemical feed system installation incorporating the highest degree of standards for the specified type of service shall be furnished by the system supplier whether or not specifically mentioned in these Specifications or shown on the Drawings.

2.02 MATERIAL AND EQUIPMENT

A. Hydrofluorosilicic Acid Feed System:
   1. Chemical Bulk Storage Tank:
      a. The Contractor shall furnish and install one (1) new chemical bulk storage tank and stand in the existing fluoride room or building as shown on the Drawings and as specified in Section 13219: Polyethylene Chemical Storage Tanks.
   2. Chemical Day Tank:
      a. The Contractor shall furnish and install one (1) chemical day tank and tank scale in the existing fluoride room or building as shown on the Drawings and as specified in Section 13219: Polyethylene Chemical Storage Tanks.
   3. Chemical Metering Pumps:
      a. The Contractor shall furnish and install one (1) metering pump skid and containment pallet in the existing fluoride room or building as shown on the Drawings and as specified in Section 11245: Packaged Chemical Feed System. The metering pump skid shall include two (2) diaphragm metering pumps and accessories in accordance with Section 11245.

B. Sodium Hypochlorite Feed System:
   1. Chemical Bulk Storage Tank:
      a. The Contractor shall furnish and install two (2) chemical storage tanks in the existing chlorine room or building as shown on the Drawings and as specified in Section 13219: Polyethylene Chemical Storage Tanks.

2. Chemical Metering Pumps:
    a. The Contractor shall furnish and install two (2) metering pump skids (pre-disinfection and post-disinfection) in the existing chlorine room or building as shown on the Drawings and specified in Section 11245: Packaged Chemical Feed System. The pre-disinfection metering pump skid shall include two (2) diaphragm metering pumps and accessories and the post-disinfection metering pump skid shall include two (2) diaphragm metering pumps and accessories in accordance with Section 11245.

C. Chemical Feed System Piping:
1. Polyvinyl Chloride (PVC) Pipe and Fittings:
    a. Materials for polyvinyl chloride pipe and fittings shall be as specified in Section 15070: Schedule 80 Polyvinyl Chloride (PVC) Pipe and Fittings.
    b. Joints and jointings shall be as specified in Section 15070: Schedule 80 Polyvinyl Chloride (PVC) Pipe and Fittings.
2. Polyethylene (PE) Tubing:
    a. Provide blue polyethylene tubing conforming to AWWA C901 and AWWA C800 where tubing is called for in the Drawings. Design for continuous indoor and outdoor (ultraviolet-resistant) service. Minimum operating pressure shall be 150 psi and Dimension Ratio DR-9 size. The tubing shall be designated copper tube size and the material shall be PE 2406; cell classification minimum shall be PE 213323C in accordance with ASTM 3350. Burst pressure shall be at least 4.0 times the specified operating pressure. Join tubing to pipe with a single-barb male adapter fitting. Secure tubing to the fitting with a stainless steel hose clamp. Connect tubing sections by means of barbed insert-type hose fittings with stainless steel clamp.
    b. Products: Charter Plastics – Blue Ice, Endot – Endopure Blue, or JM Eagle – Pure Core.
    c. Test pressure for PE tubing shall be the same as the PVC piping to which it is connected.
3. Chemical Pull Boxes:
    a. Provide a standard polymer meter box with anti-float inset cover where indicated on the Drawings. Chemical pull box shall be a minimum of 14 inches wide, 26½ inches long, and 18 inches high.
    b. Products: DFW Plastics, Inc. – DFW 1324C-18 or approved equal.
4. Piping Schedule:
    a. Refer to Table 15090-1 for the Schedule of Materials to be used on each piping system, the conditions of service, and the hydrostatic testing requirements.
5. Fabrication and Manufacture:
    a. A union shall be provided within 2 feet of each threaded end valve unless there are other connections that will permit easy removal of the valve. Unions shall also be provided in piping at locations adjacent to devices or equipment that may require removal in the future and locations required by drawings or specifications.
    b. Taps for pressure gauge connections on the suction and discharge of pumping units shall be provided with a nipple and a shutoff gauge cock.
    c. Pipe hangers and supports shall be provided as specified in Section 15126: Hangers and Supports.

2.03 ACCESSORIES

A. Safety Equipment:
   a. The Contractor shall be responsible for coordinating with the water plant personnel for protection of the existing safety equipment to be reused in the new facilities.

B. Emergency Shower and Eyewash:
   1. All stainless or pvc free-standing, combination eye-wash and drench showers for outside installations and separate eye wash stations for inside installations shall be provided and located as shown on the Drawings. Shower and eyewash stations shall be provided with 50x50 mesh water strainer, a stainless/pvc dust cover, stainless steel/pvc bowl, floor flange mount, foot treadle, emergency sign and high visibility stripe, and alarm flow switch with light. Shower and eyewash shall meet ANSI Z358.1 standard. Combination units shall be capable of operating simultaneously. Shower must deliver minimum of 20 gpm and provide a column of water 20 inches wide at 60 inches above the floor. Eye/face wash equipment must deliver minimum of 3 gpm for 15 minutes and be designed so that the flushing flow remains on without the use of operators hands. Emergency Shower and Eyewash stations shall be Haws Model 8330 or equal with stainless steel materials for hypochlorite buildings and Haws Model 8336 or equal with pvc materials for fluoride buildings.

C. Quick Connect Coupling for Chemical Service:
   1. Quick connect couplings for Chemical Service shall be male adaptor/female thread type. Provide dust cap and security chain with each coupler. Bodies shall be glass fiber reinforced polypropylene. Gaskets shall be Viton. Adaptors shall be Ever-tite Coupling Co. Port A/DC, Banjo Corporation Male Adapter/Female Thread with dust cap, Murray Equipment Inc., Style A/DC, or equal.

D. Flexible Expansion Joints:
   1. Flexible expansion joints shall be molded PTFE type with flanged ends and two convolutions and be suitable for use in corrosive applications. Flange configurations shall be factory coated with rust inhibitive primer and be dimensionally tapped to ANSI 125/150#. PTFE expansion joints shall have contour bellows molded from extruded tubing utilizing Teflon T-62 resins, stainless steel reinforcing rings, factory set limit bolts, and neoprene grommets. Flexible expansion joints shall be Proco Series 442-BD, or equal.

2.04 SPARE PARTS

A. Special tools required for normal operation and maintenance shall be supplied for each piece of equipment furnished.

B. Each piece of equipment shall be furnished with the manufacturer's recommended spare parts for the first two (2) years of operation.

C. All tools and spare parts shall be furnished in containers clearly identified with indelible markings as to their contents and referenced to the chemical feed system. Each container shall be packed with its contents protected for storage. All tools shall be furnished in steel tool boxes.

D. Spare parts shall include:

- Chlorine
  - (1) Pressure Relief Valve
    - One rebuild kit per facility
  - (2) Back Pressure Regulator
    - One rebuild kit per facility
  - (3) Pulsation Dampener
    - One rebuild kit per facility
  - (4) Gauge Guards
    - Two spare replacements per facility
- Fluoride
  - (1) Pressure Relief Valve
    - One rebuild kit per facility
  - (2) Back Pressure Regulator
    - One rebuild kit per facility
  - (3) Pulsation Dampener
    - One rebuild kit per facility
  - (4) Gauge Guards
    - Two spare replacements per facility

PART 3 – EXECUTION

3.01 PREPARATION

A. All fittings, couplings, specials, and other exterior surfaces of buried piping not protected with plastic coating shall be tape-wrapped in the field. All surfaces to be tape-wrapped

shall be thoroughly cleaned and primed in accordance with the tape manufacturer's recommendations immediately before wrapping. Tape-wrapping shall be two-ply (half lap) application or as required to provide a total installed tape thickness of not less than 60 mils. Joints in plastic coated pipe shall be cleaned, primed, and tape-wrapped after installation.

3.02 INSTALLATION

A. Equipment:
   1. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required lubricants for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

B. Pipe:
   1. Pipe shall be installed as specified, as indicated on the drawings, or, in the absence of detail piping arrangement, in a manner acceptable to the Engineer.
   2. Pipe shall be cut from measurements taken at the site and not from the drawings. All necessary provisions shall be taken in laying out piping to provide throughout for expansion and contraction. Piping shall not obstruct openings or passageways. Pipes shall be held free of contact with building construction so as not to transmit noise resulting from expansion.
   3. Stuffing box leakage from water sealed pumps shall be piped to the nearest point of drainage collection.
   4. Buried PVC piping shall be "snaked" in the trench and shall be kept as cool as possible during installation. PVC pipe shall be kept shaded and shall be covered with backfill immediately after installation and testing.

5. All piping shall be installed so that lines are readily accessible for cleaning. At changes in direction in all chemical piping, tees shall be provided with extra openings plugged to facilitate cleaning. Teflon thread tape or Teflon thread sealer shall be applied to the threads of all plugs so that they can be easily removed. At each point where hose or reinforced plastic tubing is connected to rigid piping, a quick disconnect coupling shall be provided.

C. Pipe joints shall be carefully and neatly made in accordance with the requirements that follow:
   1. Threaded:
      a. Pipe threads shall conform to ANSI 82.1, NPT, and shall be full and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed after threading and before assembly to remove all burrs.
      b. Threaded joints in plastic piping shall be made up with Teflon thread tape applied to all male threads.
   2. Solvent Welded: All joint preparation, cutting, and jointing operations shall comply with the pipe manufacturer's recommendations and ASTM D2855. Pipe ends shall be beveled or chamfered to the dimensions recommended by the manufacturer. Newly assembled joints shall be suitably blocked or restrained to prevent movement during the set time recommended by the manufacturer. Pressure testing of solvent welded piping systems shall not be performed until the applicable curing time, set forth in Table X2.1 of ASTM D2855, has elapsed.
   3. Flanged: Flange bolts shall be sufficiently tightened to slightly compress the gasket and effect a seal, but not so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly.

D. Pipe Sleeves:
   1. Piping passing through or below concrete or masonry shall be installed through sleeves installed before the concrete is placed or when masonry is laid.
   2. Unless otherwise indicated on the drawings, all pipes passing through or below walls or slabs shall be sealed watertight with special rubber gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.
   3. Buried pipe sleeves enclosing chemical-piping shall be sloped to the open end as indicated on the drawings to allow observation of leakage of the chemical piping. The upper end of each sleeve shall be sealed watertight.

3.03 INSPECTION AND TESTING

A. Equipment:
   1. Furnish the services of a factory representative who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise test runs of the equipment.

2. Upon completion of installation, the manufacturer, in the presence of the Engineer, shall perform a preliminary test (no chemicals) over the full range of each system to insure the functioning of all component parts to the satisfaction of the Engineer. The test shall be over the full range of capacity. The manufacturer shall furnish all labor and equipment. Power shall be supplied by the Contractor. Approval of the preliminary test by the Engineer shall not constitute final acceptance of the equipment furnished.
3. After the plant is in operation, a full operating test shall be performed in the presence of the Engineer and a qualified manufacturer's representative on the system. The manufacturer shall furnish all labor, materials, and equipment required for such tests and shall correct any deficiencies noted by repairing or replacing the defective component and retesting as required until the equipment meets the Specifications and the satisfaction of the Engineer. The manufacturer shall have 30 days to make the changes necessary to meet the Specifications. If after said 30 day period all deficiencies have not been satisfactorily corrected, the Owner may order the manufacturer to remove the equipment from the installation and refund to the Owner all payments made to Owner. Chemicals for the full operating test shall be furnished by the Contractor.

B. Piping:
1. All shop applied plastic coatings and tape wrap on pipe or fittings shall be inspected for holidays and other defects after receipt of the pipe or fitting on the job and immediately before installation. All field applied tape wrap on pipe, pipe joints, fittings, and valves shall be inspected for holidays and other defects following completion of wrapping. Inspection of plastic coatings before installation of the pipe or fitting in the sleeve shall be made where, in the opinion of the Engineer, the coating may have been damaged during assembly. Holidays and defects disclosed by inspection shall be repaired in accordance with the recommendations of the coating or tape wrap manufacturer, as applicable.
2. Inspection shall be made using an electrical holiday detector. The detector and inspection procedures shall conform to the requirements of Section 4.5.
3. Pressure and Leakage Testing:
    a. All specified tests shall be made by and at the expense of the Contractor in the presence, and to the satisfaction of, the Engineer. Each piping system shall be tested in accordance with Section 15044 and, at a minimum, must experience no loss of pressure for at least one hour.
    b. Compressed air or pressure gas shall not be used to test plastic piping unless specifically recommended by the pipe manufacturer.
    c. Leakage may be determined by loss of pressure, soap solution, chemical indicator, or other positive and accurate method acceptable to the Engineer. All fixtures, devices, or other accessories that are to be connected to the lines and that would be damaged if subjected to the specified test pressure shall be disconnected and ends of the branch lines plugged or capped as required during the testing procedures.
    d. Drainage and venting systems shall be tested by filling with water to the level of the highest vent stack. Openings shall be plugged as necessary. Each system shall hold the water for 30 minutes without any drop in the water level.

e. All necessary testing equipment and materials, including tools, appliances and devices, shall be furnished and all tests shall be made by and at the expense of the Contractor and at such time as directed by the Engineer.

4. Cleaning:
   a. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, dirt, and other foreign matter when erected. The interior of all lines shall be thoroughly cleaned to the satisfaction of the Engineer before being placed in service.
   b. Lines that have been flushed with water shall be air-dried with compressed air immediately following drainage.
5. All joints in piping shall be tight and free from leaks. All joints which are found to leak by observation or during any specified test shall be repaired and tests repeated.

TABLE 11241-1 CHEMICAL FEED SYSTEM PIPING SCHEDULE

Service	Pipe I.D.	Size (in.)	Pipe Material	Class	Specification Section No.	Test Pressure (psig)
Hydrofluorosilicic Acid (Inside and Outside)	F	2 & Smaller	PVC	SCH 80	15070	150
Sodium Hypochlorite (Inside)	C	2 & Smaller	PVC	SCH 80	15070	150
Sodium Hypochlorite (outside)	C	1 & Smaller	PE	DR-9	15010	150
Vent	V	3 & Smaller	PVC	SCH 80	15070	25
Sample	SP	½”	PE	C901 or DR-9	15100	150

END OF SECTION

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SECTION 11245

PACKAGED CHEMICAL FEED SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. This Section covers the furnishing of all labor, materials, equipment, accessories, and incidentals required for installation, placing in operation, and field testing of the following packaged chemical feed systems (including chemical metering pumps, motors, controls, piping, valves, and accessories) as specified herein and as shown on the Drawings:
      a. Pre-disinfection sodium hypochlorite system
      b. Post-disinfection sodium hypochlorite system
      c. Hydrofluorosilicic acid (Fluoride) system
   2. These Specifications are intended to give a general description of the equipment requirements, but do not cover all details that will vary in accordance with the requirements of the specific equipment and application.
   3. For all skids there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not, as required for an installation incorporating the highest standards for this type of service.

B. Related Work Described Elsewhere:
   1. Section 01300: Submittals
   2. Section 01730: Operating and Maintenance Data.
   3. Section 11241: Chemical Feed Systems.
   4. Mechanical piping, valves, pipe hangers, and supports are in Division 15.
   5. Instrumentation and Controls are included in Division 13.
   6. Electrical is included in Division 16.

C. General Design:
   1. All of the equipment specified herein is intended to be new standard equipment for use in the liquid chemical feed systems and shall include, but not be limited to, the following material and equipment:
      a. Fabricated skids with containment and leak detection.
      b. Diaphragm metering pumps (electronically or mechanically actuated as required for each application.
      c. Calibration chambers.
      d. Pressure relief valves.
      e. Pulsation dampeners with integral pressure gauge.
      f. Backpressure valves.
      g. Motors, drives and controls.

h. Isolation valves, pressure gauges, interconnecting piping, and fittings as required to make a completely functioning metering pump skid to operate as shown in the Drawings and described herein.
i. Junction boxes for the termination of a power supply, control and signal wire to each prewired skid.

2. All working parts of identical pumps and motors shall be of standard dimension built to limit gauges or formed to templates such that parts will be interchangeable between like units and such that the Owner may at any time in the future obtain replacement and repair parts for those furnished in the original machines. All parts shall be properly stamped for identification and location in the machines as shown on the Operation and Maintenance Manuals furnished.
3. Equipment, pumps, skids and ancillary equipment shall meet the capacities and requirements listed in Table 11245-A (Chemical Feed System Schedule).

1.01 QUALITY ASSURANCE

A. To assure unity of responsibility, the Contractor shall assign the design and fabrication of the chemical feed system to a single system manufacturer and shall be products of a manufacturer regularly engaged in the production of such equipment. System manufacturer shall assemble the system and factory test the system as a complete system, including pumps, piping, valves and controls. The supplier shall assume complete responsibility for the satisfactory installation and proper operation of the entire system including pumps, motors, controls, and accessories.

B. The packaged chemical feed system manufacturer shall determine and verify quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and the packaged chemical system manufacturer shall review and coordinate each submittal with the requirements of the Contract Documents.

C. The pumps covered by these Specifications are intended to be standard pumping equipment of proven ability as manufactured by a reputable, qualified manufacturer having long experience in the production of such pumps. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards.

D. All equipment furnished under this Specification shall be new and unused and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein a minimum of five (5) years.

E. For all systems supplied for this project, each of the following equipment shall be by the same manufacturer.
1. Metering pumps
2. Pressure relief valves.
3. Pulsation dampeners.
4. Backpressure valves.

F. The system manufacturer shall provide a minimum of (10) references for systems that have been in operation for a minimum of (3) year. At least three (3) references shall be provided for each chemical being pumped. Determination that a manufacture is equal and acceptable will be based on evaluation of the reference projects.

G. Chemical feed system shall be manufactured by Blue Planet, or equal.

H. Mechanically actuated metering pumps shall be Prominent, Pulsafeeder or Grunfos.

I. Electronically Actuated metering pumps shall be Prominent, Pulsafeeder or Grunfos.

J. Chemical containment pallets shall be as manufactured by Interstate Products, Inc. or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings: Submit shop drawings in accordance with the General Conditions, Section 01300, and the following.
   1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
   2. A copy of the contract mechanical process, structural, electrical and instrumentation drawings relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
   3. Certified shop and erection drawings showing dimension and locations of equipment on the fabricated skid, including locations of pumps, piping, valves, pulsation dampeners, pressure gauges, calibration columns, electrical equipment, pipe and valve supports, and panels.
   4. Descriptive literature, bulletins, and/or catalogs of each individual piece of equipment for each skid

5. Drawings showing the design of the fabricated skid, including support systems, access panels, and other assembly arrangements.
6. Data on the characteristics and performance of each pump. Data shall include guaranteed performance based on actual shop tests of similar units to show that they meet the specified requirements.
7. A complete total bill of materials of all equipment including the weights of equipment furnished.
8. A list of the manufacturer's recommended spare parts, include gaskets, packing, diaphragms. List bearings by the bearing manufacturer's numbers only.
9. Complete motor data.
10. Copies of all factory test results, if specified in PART 2 - PRODUCTS of this Section of the Specifications.
11. The recommended summer and winter grades of lubricants for metering pumps along with alternative references to equal products of other manufacturers.
12. Complete wiring diagrams and schematics of each panel, controller, control device furnished under this Section.
13. Quality Control Submittals:
    a. System Manufacturer's Certification of Compliance demonstrating that all materials of construction that come into direct or indirect contact with the chemicals being pumped are fully compatible for the specified service.
    b. System Manufacturer's Certification of Compliance that the factory finish system is identical to the requirements specified herein.
    c. Special shipping, storage and protection, and handling instructions.
    d. System Manufacturer's printed installation instructions.
    e. System Manufacturer's Certificate of Proper Installation.
    f. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
    g. Field Performance Test Certificate.
    h. Any additional information to show conformance with these specifications.

B. In the event that equipment can not conform certain details of the specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

1.04 OPERATIONS AND MAINTENANCE DATA

A. Operating and Maintenance Instructions:
   1. Operating and maintenance manuals shall be furnished.
   2. 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 operation and maintenance personnel unfamiliar with such equipment.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The skids and all parts and equipment 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. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

C. Finished iron or steel surfaces not shop painted shall be properly protected to prevent rust and corrosion.

D. 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.

E. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.06 WARRANTY AND GUARANTEES

A. Provide full equipment service/parts warranty as specified in the General Conditions.

B. Entire pump skid and equipment shall be warranted for a period of three (3) years.

PART 2 – PRODUCTS

2.01 GENERAL

A. The pumping units required under this section shall be complete including proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.

B. All equipment and piping shall be rigidly and accurately anchored into position and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed. All bolts, nuts, and washers shall be of 316 stainless steel, except for the Hydrofluorosilicic Acid and Sodium Hypochlorite pumps and equipment which shall be Hastelloy-C

C. Stainless steel nameplates giving the name of the manufacturer, model number, rated capacity, speed, and any other pertinent data shall be attached to each item of equipment.

D. A separate stainless steel nameplate with the equipment identification number shall be attached to each item of equipment in an easily visible location. The lettering shall be stamped on using ¼-inch high or larger letters.

E. Stainless steel nameplates giving the name of the manufacturer, serial number, model number, horsepower, speed, voltage, amperes, and other pertinent data shall be attached to each motor.

F. Engraved laminated nameplates giving the name and function of all selector switches, pushbuttons, alarm lights and control devices shall be securely attached to each panel furnished.

G. All electrical materials and equipment shall be Underwriters Laboratories, Inc. listed and shall otherwise be equal to those specified under Division 16: Electrical.

H. All materials of construction shall be compatible with and fully resistant to the liquids being pumped.

2.02 MATERIALS AND EQUIPMENT

A. Fabricated Skid:
   1. The skid back, deck, pump supports, and structural components shall be fabricated of Polypropylene (PP), Polyethylene (PE) or PVC (½"). Reinforcing gussets shall be provided to provide support.
   2. Fasteners shall be Type 316 stainless steel complying with ASTM A 193, Grade B 8M for nuts, except for the Hydrofluorosilicic Acid and Sodium Hypochlorite pumps and equipment which shall be Hastelloy-C.
   3. The skids shall be equipped with clear Plexiglas spray shields. The spray shields shall extend on the front and sides of the skid. Spray shields located on the fronts of the skid shall slide to open. Spray shields located on the side of the skid shall be of the removable type and shall include handles. The design of the spray shield shall be such that the shield can be removed without the removal of bolts. The spray shields shall have all appropriate supports as required by the manufacturer. Vertical support members for spray shields shall be designed so that skid accessibility is not compromised and so that the opening of a shield does not interfere with other equipment in the chemical room.

B. Metering Pumps – Mechanically Actuated:
   1. The chemical metering pumps shall be of the single diaphragm, motor driven, mechanically-actuated design. The pump, motor, gear reducer, and stroke controller, where required, shall be mounted on a common base plate.
   2. The pump shall include integral motor, oil-lubricated gear reducer, and cam-and-spring drive mounted in an aluminum housing. The housing shall be sealed into an outer plastic housing for corrosion protection with heats sinks for cooling.
   3. The liquid end shall be physically separated from the drive unit by a back plate with weep hole creating air gap separation.
   4. Pump shall be provided with precise seating, suction, and discharge ball check valves. The check valves shall be removable from the liquid end for servicing or replacement. The suction and discharge check valve cartridges or seats and element shall be easily field replaceable. Check valves shall be single or double ball, in line (straight-through) type check valves. No spring-loaded check valves will be acceptable.

5. The diaphragm shall have a steel core, vulcanized into a nylon-reinforced EPDM backing. The diaphragm fluid contact surface shall be compatible with the materials to be pumped as listed in the Service Conditions. The pump shall be capable of a 8 foot suction lift based on water at 70°F.
6. The pumps flow repeatability shall be within ±3 percent over the turndown ratio. Deviation from linearity shall not exceed ±3 percent over the turndown ratio. The pumps shall be capable of accepting manual or electric control, either factory mounted or by field conversion. Pumps shall be provided with manual 0-100 percent stroke adjustment via a unit mounted micrometer unless an automatic stroke adjustment mechanism is specified in the Service Conditions. The manual stroke adjustment shall be capable of being performed while the pump is operating or idle.
7. Materials of construction for the pumping units shall be compatible with the fluids to be pumped.

C. Metering Pumps – Electronically Actuated:
1. Chemical metering pumps shall be positive displacement non-hydraulic, microprocessor-controlled, solenoid driven, mechanically actuated diaphragm type pumps. Output shall be shall be adjustable while pumps are in operation. Positive flow shall be ensured by a minimum of four ball type check valves. A bleed valve shall be provided for the manual evacuation of entrapped air or vapors and safe relief of pressure in the discharge line.
2. To prevent damage to pump from overheating, the solenoid shall have automatic reset thermal overload protection. For overpressure conditions, pump shall automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35% when pump is set at maximum stroke.
3. The pump liquid end shall be physically separated from the drive unit by a back plate with a weep hole creating an air gap.
4. Pump drive shall be encased in a water resistant housing constructed of a chemically resistant glass filled polyester. The electronic circuitry shall be mounted at the rear of the pump for maximum protection against chemical intrusion.
5. Pump valves shall be ball type, with balls seating on combination valve seat and seal ring. Valve seat and seal rings shall be renewable by replacing only the combination seat-seal ring.
6. Materials of construction for the pumping units shall be compatible with the fluids to be pumped.

D. Pressure Relief Valves:
1. Pressure relief valves shall be provided on the discharge piping of each metering pump as shown on the Drawings. Pressure relief valves shall use a diaphragm design and be externally adjustable by means of a screw driver.
2. The size of the pressure-relief valve shall match the associated metering pump capacity.
3. Return pressure relief valve piping to the suction side of the metering pump.

E. Backpressure (Pressure Sustaining) Valves:
1. Backpressure valves shall be provided on the discharge piping of the metering pumps as shown on the Drawings.

2. Backpressure valves shall use a diaphragm design and be externally adjustable by means of a screwdriver.
3. Valve shall be size to match the associated metering pump capacity.

F. Pulsation Dampeners:
1. Pulsation dampeners shall be provided for installation on the discharge piping of each metering pump as shown in the Drawings.
2. Pulsation dampeners shall provide for a volumetric residual fluctuation of ±4 percent or less based upon a single feed pump in operation.
3. The pulsation dampeners will be equipped with a pressure gauge and charging valve mounted on top of the gas chamber. Pulsation dampeners shall be supplied by the pump manufacturers.

G. Calibration Columns:
1. Provide transparent calibration column to be mounted on the suction piping of each chemical feed system as shown on the Drawings.
2. The calibration column shall be piped such that one (1) metering pump can be calibrated while the other pumps are fully operational.
3. The calibration columns shall be supplied with NPT taps for connection of piping.

H. Pressure Gauges:
1. Pressure gauges shall be provided on the discharge piping of each metering pump and as shown in the Contract Drawings.
2. Gauges shall have a PVC diaphragm seal and shutoff valve. Gauges will be constructed of materials which are completely resistant to corrosion by the chemical for the service for which they are intended.
3. Shutoff valves shall be PVC with seals that are resistant to the chemical applications.

I. Piping and Fittings:
1. Unless otherwise indicated, all piping and fittings for the skids shall be Schedule 80 PVC.

J. Power and Controls:
1. Provide skid mounted NEMA 4X FRP junction box for power and control/signals for each skid. Skid supplier shall distribute power from the junction box to associated skid mounted pumps. The power for each pump on the skid shall be terminated in the junction box. All control and signals wires shall be prewired to the junction box.
2. Power supply for chemical feed pump shall be 120VAC, 1-phase, 60-Hz.
3. Junction box shall be sized in accordance with NEC requirements and shall contain appropriate terminal strips for skid mounted wiring and external wiring.
4. Junction box shall be outside-mounted on the skid in a location to provide unobstructed operator/maintenance access.
5. Input and output signals and alarms shall be as shown on the drawing and listed below.
    a. Input
        1) Run Command (Start)
        2) Speed Command (Set Pump Speed 0-100%)
        3) Control Status for each pump (Auto/Off)

b. Output
    1) Fault or Fail
    2) Remote Status for each pump (Auto or not)
    3) Speed Feedback for each pump
    4) Pump Fail to Start
    5) Run
6. Furnish complete wiring diagrams for all terminal boxes mounted on the skid. Clearly identify customer connection points for all external wiring for proper system operation.

K. Wiring and Conduit within the Skid:
1. Wiring for power and control circuits shall be sized and installed per the NEC.
2. Color-code control wiring in switching and control assemblies per ICEA Method 1, NEC applications, Option A. Jacket shall be black PVC.
3. Lay out conductors neatly so they may be followed by eye from one terminal to another. Wiring shall be vertical or horizontal. Color-coding shall be such that electrically common interconnections of devices are the same color. The colors may be used more than once but not in the same circuit or cable grouping.
4. Power and control cable shall be copper, insulated for 600 volts, 75°C wet and 90°C dry locations, UL Type THWN or XHHW. Insulation jacket shall be nylon. Install bare or green insulated copper conductors in power circuits for grounding connections. The cable shall meet the requirements ofUL83.

L. Chemical Containment Pallet:
1. Provide one (1) chemical containment pallet for each skid. Chemical metering pump skids shall be mounted on top of the chemical containment pallets.
2. Chemical containment pallet shall be of polyethylene construction and suitably sized such that no part of the chemical metering pump skid is overhanging. The chemical containment pallet shall be of sufficient strength to hold the weight of the metering pumps skids.
3. Chemical containment pallet shall comprise a hollow base for storing spills grating to allow for chemical spills to be contained. Pallets shall store a minimum of 30 gallons and a maximum height of 6.5-inches.
4. Valved ¾-inch outlet with hose connection shall be provided to drain the pallet by gravity or pump.
5. Leak Detection: A float-type leak detection system shall be provided to detect liquid level in the pallet sump and shall dry contacts for remote monitoring. All leak detection system components shall be compatible with the chemical being used.

2.04 SPARE PARTS

A. All special tools required for normal operation and maintenance of the equipment shall be furnished with the equipment by the manufacturer.

B. The following spare parts shall be furnished:
1. One (1) box of fuses of each size furnished.
2. One (1) container of each type of lubricating or hydraulic oil required.

3. One (1) maintenance/re-built kit for each chemical metering pump. Maintenance kits shall include but not be limited to diaphragm, check valve seats, gaskets and O-rings.
4. One (1) maintenance/re-built kits kit for each pressure relief valve for each pump skid.
5. One (1) maintenance/re-built kits kit for each backpressure valve for each pump skid.
6. One (1) spare bladder for each pulsation dampener for each pump skid.
7. One (1) spare valve of each size for each pump skid.
8. Parts list for all serviceable components.

C. The Manufacturer shall recommend and supply all spare parts in addition to the aforementioned necessary for the first thee (3) years of operation. Spare parts shall be marked with parts numbers and packed in suitable containers also marked with the parts numbers.

D. All tools and spare parts shall be furnished in containers clearly identified with indelible markings as to their contents. Each container shall be packed with its contents protected for storage. All tools shall be furnished in steel tool boxes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of the pumps, drivers, and accessories shall be in strict accordance with the manufacturer's instructions and recommendations in the arrangement shown on the Drawings.

B. Installation shall include furnishing the required lubricants for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

C. Assemble and mount components on the fabricated skid or base at the factory. Provide the following minimum clearances around the equipment:
1. 12 inches between adjacent pumps.
2. 6 inches between parallel pipes.

D. Design skid to provide access to the manual stroke control knobs located with the metering pumps.

E. Provide separate supports for pulsation dampener and calibration tubes. Do not mount unsupported devices directly on the piping.

F. Provide fiberglass supports with Type 316 stainless steel fasteners and hardware for the piping, with the exception of Hydrofluorosilicic Acid and Sodium Hypochlorite service, in which case fasteners and hardware shall be Hastelloy-C.

G. Provide a support for each pipe at its termination point at the edge of the skid, within 3 inches of any isolation valve.

H. Mount electrical and control/signal termination boxes on the side of the skid, or on top, if there is no clearance on the side.

I. Provide the front of the skid clear of any piping or conduits to allow for maintenance access to the skid components. This clear access side shall not include any side that is within 3 feet of a wall.

3.02 INSPECTION AND TESTING

A. Furnish the services of a factory representative who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise test runs of the equipment skids.

B. Upon completion of installation, the factory representative, in the presence of the Engineer and Owner, shall perform a preliminary test of the complete chemical feed system as specified under Section 11241: Chemical Feed Systems.

3.03 START-UP AND INSTRUCTION

A. A factory-trained service engineer shall be provided for system start-up, calibration and instruction briefings for operating personnel. Services shall be furnished for a minimum of eight (8) days, in at least eight (8) trips, with additional time furnished if required to correct problems or deficiencies.

B. On-Site and Classroom Training: A factory-trained service engineer shall be provided training, either on-site or in a classroom designated by the Owner for the minimum person-days listed below, travel time excluded:
   1. 2 person-days installation, operation, and maintenance training.
   2. All training shall be recorded on a DVD and provided to the County with the O&M manuals.

Table 11245-A Chemical Feed System Schedule

Item	Pre and Post Chlorination	Fluoride
Liquid Pumped	12% Sodium Hypochlorite	23% Hydrofluosilicic Acid
Metering Pump		
Type	Mechanically Actuated	Electronically Actuated
Number of Skids	2 (Pre and Post)	1
Number of Pumps per Skid	2	2
Capacity Range		**(gph)**
Cypress Walk	1.50 to 6.24 gph	0.19 to 0.77 gph
Orangewood	14.76 to 35.43 gph	0.39 to 0.93 gph
Hunter's Creek	11.73 to 23.47 gph	0.48 to 0.95 gph
Oak Meadows	6.47 to 23.1 gph	0.19 to 0.80 gph
Maximum Pressure Range	100 psig	50 psig
Minimum Suction Lift	8 ft	8 ft
Stroke Length Control	Manual	Manual
Stroke Speed Control	Manual and Remote signal 4-20 mA	Manual and Remote signal 4-20 mA
Pump Materials of Construction		
Liquid End Body	PVDF or PVC	PVC, Polypropylene, or PVDF
Diaphragm	PTFE	PTFE
Check Valve Balls	Ceramic	Ceramic
Seat and O-rings	PTFE or Viton	PTFE or Viton
Hardware	Hastelloy-C	Hastelloy-C
Pressure Relief Valve Setting, **psig**	100 psig	100 psig
Backpressure Valve Setting, **psig**	50 psig	50 psig
Calibration Column	2,000 mL with 10 mL graduations	500 mL with 5 mL graduations

END OF SECTION

DIVISION 12
FURNISHING (NOT USED)

DIVISION 13
SPECIAL CONSTRUCTION

SECTION 13121

FRP BUILDINGS, SHELTERS AND ENCLOSURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Pre-engineered buildings.

B. Pre-engineered shelters.

C. Pre-engineered enclosures.

1.02 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals as required for the provision and proper installation of the following FRP structures as shown on the Drawings and specified herein.
   1. Sodium Hypochlorite Fill Station
   2. Fluoride Fill Station

B. All anchor bolts, gaskets, sealants, and other accessories and appurtenances, required for a complete and operating installations shall be included whether specifically mentioned or not.

C. **See Table 13121-A for service requirements, features and accessories required for this project.**

1.03 REFERENCES

A. ASTM C 518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

B. ASTM D 256 - Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

C. ASTM D 638 - Standard Test Methods for Tensile Properties of Plastics.

D. ASTM D 732 - Standard Test Method for Shear Strength of Plastics by Punch Tool

E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

F. ASTM D 792 - Standard Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

G. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

H. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics By means of a Barcol Impressor.

I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ANSI/NSF 61 - Drinking Water System Components - Health Effects.

1.04 QUALITY ASSURANCE

A. All FRP structures shall be supplied by an experienced firm who has continually engaged in the manufacture and/or fabrication of fiberglass custom reinforced plastic structures, shelters and enclosures. Firms not listed in this specification must clearly document a minimum of five (5) years experience with similar projects of equal scope of design.

B. The contractor shall assure that all field dimensions are taken accurately and communicated properly to the FRP Fabricator, that other trades will not affect a proper installation of the FRP, and that all manufacturer's instructions and recommendations are followed.

C. The manufacturer shall maintain a continuous quality control program and upon request shall furnish to the engineer certified test results of the physical properties.

D. Products shall be manufactured by Warminster Fiberglass Company, PlastiFab, or MFG.

1.05 SYSTEM DESCRIPTION

A. Factory-fabricated, pre-engineered structures to withstand 125 mile per hour wind load (or the most recent Florida Building Code, whichever is more stringent) and direct exposure for outdoor installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products on flat surface and protect from construction traffic, and damage.

1.07 SUBMITTALS

A. Submit complete shop drawings and product data for all FRP materials and fabrications as required by this scope of work

B. Submittal shall include a copy of this Specification and clearly indicate compliance or deviation with each item.

C. Shop drawings shall show all materials as required and include all dimensions, connections, fasteners, structural supports, adjustments, openings, anchors, tolerances, assembly and installation details as required, including:
   1. Manufacturer's standard details and catalog.
   2. Data demonstrating compliance with referenced standards.
   3. Installation instructions and manufacturer certification that materials comply with specified requirements and are suitable for the intended application.

PART 2 – PRODUCTS

2.01 GENERAL

A. All FRP materials shall be manufactured with vinyl ester, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

B. Structural FRP shall be constructed of continuous strand roving, continuous transverse mat, and synthetic surface veil, and shall include ultraviolet (UV) inhibitors.

C. All cuts, holes, and abrasion (including cuts for pipe openings) shall be sealed according to manufacturer's instructions.

2.02 MATERIALS

A. Molded composite: Exterior and interior resin-fiberglass laminate with foam core.
   1. Laminate: Polyester resin and chopped strand fiberglass; minimum glass Content of 25%.
      a. Exterior surface: White gel coat with low luster finish, smooth and free from fiber pattern, roughness, or other irregularities. Exterior shall be UV resistant.
      b. Exterior laminate: 1/8 inch thick, minimum, chemically bonded to gel coat. Interior laminate to be 1/8 inch thick, minimum.
      c. Interior laminate: White color, encapsulate core in place.
      d. Laminate properties:
         1) Tensile strength (ASTM D 638): 11,000 PSI
         2) Flexural strength (ASTM D 790): 18,000 PSI
         3) Shear strength (ASTM D 732): 12,000 PSI
         4) Barcol hardness (ASTM D 2583): 40.
         5) Impact (ASTM D 256): 12 ft lbs/per inch.
         6) Density/specific gravity (ASTM D 792): 93.6 PCF/1.5.
         7) Surface burning characteristics (ATSM E 84): flame spread less than 150 and smoke density less than 1000.

B. Core. Rigid closed cell, self extinguishing, polyisocyaqnurate foam with a density of 2.0 pounds per cubic foot. 1 inch thick with a minimum insulating value of R 7.

C. Core Properties:
   1. Thermal conductivity (ASTM C 518): 0.13 BTU Inch/ Hr. SF F.
   2. Density/specific gravity (ASTM D 1622): 2.0 PCF/ .03.
   3. Surface burning characteristics (ASTM E 84): Flame spread less than 35, smoke density less than 240.

2.03 COMPONENTS **(See Table 13121-A for components applicable to this Project)**

A. Door: One-piece, resin transfer molded (RTM) in matched metal molds to produce an industrial quality door, which exhibits a smooth finished, seamless, monolithic, warp-free composite consisting of a gel-coat, fiberglass reinforcement, polyester resin, insulating core, and internal reinforcements with all mortises, openings, recesses, and pockets molded in place.
   1. Mount door with continuous stainless steel hinge.
   2. Door gasket: Neoprene sponge rubber bulb type gasket with flexible lock to retain permanent grip.

B. Latch (Three Options, See Table 13121-A for Option applicable to this project):
   1. Non-Locking: Provide single-point keyed stainless steel cylindrical latch and stainless steel door stop with chain.
   2. Locking: Provide the point latch with stainless steel padlock hoop, door stop with chain.
   3. Panic: Provide doors with panic stainless steel hardware.

C. Base Mounting Flange Gasket: ¼ inch thick by 4 inches wide closed cell neoprene sponge rubber to provide weather tight seal around the building perimeter.

D. Louvers: Provide two, 6-inch diameter PVC wall louvers with manually adjustable damper and insect screen.

E. Lifting Eye Bolts: Provide 304 SS eye bolts in roof.

F. Load Bearing, Insulated Floor
   1. Load rating: 100 PSF
   2. One piece molded fiberglass floor with skid-resistant surface.
   3. 2 1/2 inches thick with a 2 inches thick polyisocyanurate foam core.
   4. Insulation value: R-14
   5. Bolts for attaching walls to fiberglass floor: Stainless steel.
      a. 1/2-inch diameter for buildings
      b. 3//8-inch diameter for shelters and enclosures

G. Containment floor constructed of FRP with sump and drain connection.

2.04 ONE-PIECE FIBERGLASS COMPOSITE SHELTERS AND ENCLOSURES

A. Fabricate shelters and enclosures of one-piece molded construction with composite walls and roof.

B. Form a continuous, one-piece molded composite structure with an integral 4 inch wide internal mounting flange around the perimeter.

C. Pre-drill flange on 12-inch centers with 7/16-inch diameter holes for bolting to floor.

D. Floors: Provide structural fiberglass floor mounted to concrete pad.

2.05 ACCESSORIES **(See Table 13121-A for Accessories applicable to this Project)**

A. Anchor bolts for attaching structure to concrete pad:
   1. Buildings: 316 stainless steel expansion anchors.
   2. Shelters and enclosures: 3/8 inch diameter 316 stainless steel expansion anchors.

B. Exhaust fan with fiberglass gravity shutter, and PVC shroud with insect screen.
   1. 1. 7 inches diameter; 140 CFM
   2. 2. 10 inches diameter; 585 CFM
   3. 3. 12 inches diameter; 800 CFM

C. PVC Louver: 12 inches square with fiberglass gravity shutter and insect screen.

D. Lamp:
   1. Incandescent, vapor tight.
   2. Fluorescent: 48-inch 2-bulb fixture with acrylic lens.

E. Fan and Lamp switch
   1. Interior or duplex switch.
   2. Exterior weatherproof duplex switch.
   3. Door actuated switch and selector switch- 2 position (manual/automatic)

F. Heater with thermostat and tip-over switch and heater mounting including mounting channel, outlet, and brackets.

G. Air Conditioner

H. Circuit breaker panel: 125 amp, MLO - including 4-1 pole breakers (total spaces - 12).

I. Electrical wiring in flexible, liquid tight, PVC conduit. Provide for:

J. Fan and switch.

K. Lamp and switch.

PART 3 – EXECUTION

3.01 INSPECTION

A. Upon receipt of material at job site, the contractor shall inspect all materials for shipping damage. Any damage is to be noted on the shipping receipt/packing list and reported promptly to the shipper.

3.02 INSTALLATION

A. Installing contractor to coordinate and verify that other construction trades and materials have been installed per the contract drawings, and, that they are accurate in location, alignment, elevation, and are plumb and level.

B. Install FRP structure in accordance with the installation drawings and instructions supplied by the FRP supplier.

C. Install materials accurately in location and elevation, level, and plumb. Field fabricate as necessary for accurate fit. Verify that concrete is level and true to plane and of correct dimensions o receive structure. Correct any deficiencies before proceeding.

D. Layout anchor bolt pattern according to drawings. Drill holes of depth and diameter required by anchor bolt manufacturer.

E. Erect structures true to line and plumb, free of twist and warp.

F. Install and test accessories in accordance with manufacturer's instructions.

G. Adjust components for proper operation.

TABLE 13121-A Building and Enclosure Requirements For This Project

Item	Structure 1	Structure 2
Service or Tag	Sodium Hypochlorite	Fluoride
Number	4 (one per WSF)	4 (one per WSF)
Chemical	12% Sodium Hypochlorite	23% Hydrofluosilicic Acid
Structure Type	One-piece fiberglass composite enclosure	One-piece fiberglass composite enclosure
Inside Dimensions	3’x3’x5’-9”	3’x3’x4’-0”
Floor	One piece molded with containment	One piece molded with containment
Door/Latch	Single door, locking	Single door, locking
Accessories	• Anchor bolts • PVC Louver each side (2 per unit)	• Anchor bolts • PVC Louver each side (2 per unit)

END OF SECTION

SECTION 13219

POLYETHYLENE CHEMICAL STORAGE TANKS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. This Section covers the furnishing and installation of double-walled and single-walled polyethylene chemical tanks for the storage of the chemicals required for proper operation of the treatment facilities.
   2. Tanks furnished and installed under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the fabricator unless exceptions are noted by the Engineer.
   3. The Contractor shall coordinate the work between the suppliers of equipment to be used with or connected to the storage tanks to ensure that all required provisions for mounting the accessories are included.

B. Related Work Described Elsewhere: other sections directly related to work covered in this Section include the following:
   1. Chemical Feed Systems: Section 11241.
   2. Mechanical – General Requirements: Section 15000.

1.02 QUALITY ASSURANCE

A. The tank manufacturer shall have a record of at least ten (10) installations during the previous five (5) years for the tank sizes indicated. The manufacturer must be capable of furnishing names and telephone numbers of locations that can be visibly inspected.

B. Factory Testing:
   1. Material Testing: Material from each tank shall be tested for the following:

Parameter	Test Standard	Value
Impact	ASTM D1998	120 ft-lb, min
Gel, minimum percent	ASTM D1998 Or D2765 Method C	1/32-inch of inner wall: 65 outer wall: 85 total wall: 70
Ultrasonic	ANSI/ ASTM D 1998 Hoop Stress Test 600 PSI @100 ˚F	Varies

   2. Following fabrication, the tanks, including factory applied inlet and outlet fittings, shall be hydraulically tested with water. The factory test shall compensate for the difference in specific gravity between the test water and chemical stored to simulate actual maximum operating pressures. Test methods may include adding a 2.5 psi air pad to a filled tank or filling the tank with standpipes, raising the maximum water

surface approximately 5 feet higher than the normal maximum tank level. The test duration shall be 24 hours. Following successful testing, the tank shall be emptied and dried prior to shipment.

3. An affidavit signed by the tank manufacturer shall be furnished indicating that the factory tests have been performed and the indicated conditions have been met.

1.03 SUBMITTALS

A. Materials and Shop Drawings:
   1. Complete drawings, details, and specifications covering the storage tanks and accessories shall be submitted in accordance with Section 01300: Submittals.
   2. The data shall include full information on basic materials and test data confirming the chemical resistance of the proposed materials to the intended tank contents.
   3. The data shall also indicate the sizes of all major tank components, including primary and secondary tank diameter, wall thickness, overall length, nozzle details and locations, anchor bolt locations and details, support stands, and full information and details concerning field assembly and installation.
   4. Submit design calculations for structural design of walls, support structures, and design of tie-down lugs (number, size, and embedment length of anchor bolts) signed and stamped by a structural engineer registered in the State of Florida.

B. Additional Information:
   1. If it is impossible to conform with certain details of the specifications due to different manufacturing techniques, describe completely all nonconforming aspects.
   2. Approved Materials: All materials that come into contact with the water being treated or the finished water shall be on either the EPA or NSF lists of products approved for use in contact with potable water.
   3. Manufacturer’s warranty and guarantee.

C. Operating Instructions:
   1. 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 operation and maintenance personnel unfamiliar with such equipment. The number and special requirements shall be as specified in Section 01730: Operating and Maintenance Data.
   2. A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided to instruct representatives of the Owner and the Engineer on proper operation and maintenance. With the Owner's permission, this work may be conducted in conjunction with the inspection of the installation and performance test as provided under PART 3 – EXECUTION. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The tanks and components shall be adequately protected during transportation, in storage at the job site, and during subsequent installation and construction activities. Damaged units will be rejected and shall be replaced with undamaged units at no expense to the Owner.

1.05 WARRANTY AND GUARANTEES

A. The tanks shall be warranted for 5 years to be free of defects in material and workmanship.

PART 2 – PRODUCTS

2.01 GENERAL

A. Acceptable Manufacturers: the tanks shall be as manufactured by Poly Processing, Assmann Corporation or approved equal.
B. All bulk storage tanks shall be supplied by a single manufacturer.

2.02 MATERIALS AND EQUIPMENT

A. Basic materials shall be as follows:

Tank Shell and Covers	High density cross-linked polyethylene construction with UV inhibitor and Polyethylene interior tank liner. All tanks must be NSF approved. Use of High density linear polyethylene for tank construction is not approved.
Nozzles	PVC, PP, or Integrated Molded Flanged (IMFO) outlet.
Wetted and Non Wetted Bolts, Nuts, Washers, and Hardware	AISI Type US 316 stainless steel, for services other than fluoride and sodium hypochlorite, Hastelloy-C for fluoride and Titanium for sodium hypochlorite service.

B. Performance and Design Requirements:
1. Conditions of Service: Each tank will normally be used to store the specified chemical at atmospheric pressure. The tanks shall be designed for the storage of the following liquid chemicals:

Tank Description	Fluoride Bulk Tank	Fluoride Day Tank	Chlorine Bulk
Chemical	Fluoride	Fluoride	Sodium Hypochlorite
Location	Fluoride Room	Fluoride Room	Sodium Hypochlorite
Max. Concentration Percent by Weight	25%	25%	15%
Max. Specific Gravity	1.25	1.25	1.25
Max Temp., °F	100	100	100
Min. Temp. Tank Contents, °F	Ambient	Ambient	Ambient

2. Design Criteria:
    a. Bulk tanks shall be double-wall, flat-bottom tanks. The tank assembly shall consist of one cylindrical, closed-top inner primary tank and one cylindrical open top containment outer tank. The tank assembly shall be designed to prevent rainwater and debris from entering the containment tank. The containment outer tank shall provide a minimum of 110% containment of the primary tank nominal capacity. Day tanks shall be single-wall, flat-bottom tanks with a closed top.
    b. Each tank shall be designed to withstand the hydrostatic head which would result with the tank and fill line surcharged with the stored liquid chemical to 6 inches above the top of the tank.
    c. The tanks shall conform to the requirements as shown in Table 13219-A.

C. Fabrication and Manufacture:
1. Fluoride Bulk Tanks:
    a. The tank shall be self-supporting of vertical cylindrical, seamless construction. Bulk tank shall contain a flat bottom and shall be mounted on the support stand specified herein. The tank shall have capacities and dimensions as specified in Table 13219-A.
    b. The bulk tank shall be provided with a FRP support stand. The stand shall be constructed to support the bottom of the tank at the elevation shown in the Drawings to provide positive gravity flow of the tank contents to the day tank. The tank stand shall be provided with a minimum of four support legs. The tank stand shall be designed by Florida registered professional engineer to support the bulk tank and its entire contents fully loaded. Contractor shall submit design calculations for tank stand as required by 1.03 A. 4. of this Specification Section. Tank manufacturer shall provide tie-downs to secure the bulk tank to the support stand.
    c. The tank shall be provided with a solid polyethylene cover, integrally molded with the cylindrical wall.
2. Fluoride Day Tanks:
    a. The tank shall be self-supporting of vertical cylindrical, seamless construction. The tank shall be self-supporting of vertical, cylindrical, seamless construction with a flat bottom suitable for mounting on the scale platform as shown in the Drawings. The tank shall have capacities and dimensions as specified in Table 13219-A.
    b. The tank shall be provided with a solid polyethylene cover, integrally molded with the cylindrical wall.
3. Chlorine Storage Tanks:
    a. The tanks shall be self-supporting of vertical, seamless construction. Storage tank shall contain a flat bottom for mounting on the concrete equipment pad as shown in the drawings. The tanks shall have capacities and dimensions as specified in Table 13219-A.
    b. The tank shall be provided with a solid polyethylene cover, integrally molded with the cylindrical wall.
4. The tanks shall be provided with a concrete base (pad). Base shall be level and smooth to the tolerances and required and as recommended by the tank manufacturer.
5. Testing:

a. Testing of all tanks shall be in accordance with subsections 1.02 B and 3.03 of this Specification.

2.03 ACCESSORIES

A. Accessories shall be provided on each tank as indicated on the Drawings and as specified herein.
   1. Nozzles:
      a. Nozzles for connecting piping and accessories shall be provided on each tank at the locations and of the sizes indicated on the Drawings or specified herein.
      b. Each nozzle for connecting piping and accessories 2-inch in diameter and larger shall be flanged, with flange diameter and drilling conforming to ANSI B16.5, Class 150. Nozzles shall extend at least 3 inches from outside face of tank to face of flange. Gaskets for flanged connections shall be full face; 1/8-inch thick of suitable elastomeric material to resist the attack of the chemical being stored.
      c. Nozzles for connecting piping and accessories less than 2-inches in diameter shall be female NPT extending at least 2 inches from the outside face of the tank. Bulkhead fittings may be used in lieu of nozzles for connections to the top of the tanks.
      d. The level elements mounting flange on the top of the day tank shall be above the maximum liquid level recommended by the level sensor manufacturer. The length of the nozzle shall be as recommended by the level sensor manufacturer. The center line of the nozzle shall be at least 12 inches from the tank sidewall, fill nozzle, and other obstructions.
      e. Nozzles located at the bottom of the tank on dual wall tanks shall include a fitting designed to maintain the secondary containment. The bottom containment fitting shall include PTFE expansion joint designed to accommodate movement of the primary tank in accordance with ASTM-D 1988 tolerances. All secondary containment fittings and parts shall be resistant to chemical fume corrosion.
      f. Provide drain connections and pvc ball valve on each secondary containment tank to allow the draining of any spills.

g. Each tank shall be provided with the following nozzles with the orientation as shown on the Drawings:

Connection	Nozzle Size (Inches)	Location on Tank
Fluoride Bulk Tank		
Fill	2	Top
Day Tank Fill/Drain	1	Side @ Bottom
Level Sensor	6	Top
Vent	3	Top
Fluoride Day Tank		
Fill	1	Top
Feed Pump Suction/Drain	1	Side @ Bottom
Vent	2	Top
Sodium Hypochlorite Tank		
Fill	2	Top
Overflow	2	Side @ Top
Feed Pump Suction/Drain	2	Side @ Bottom
Level Sensor	6	Top
Vent	3	Top

2. Vents: The chemical tanks shall be provided with a vent as shown on the Drawings. Vents are required to prevent drawing a vacuum inside the tank during draining or pressurizing during filling. Outside, the vent shall be equipped with an insect screen of material compatible with the chemical stored. Each bulk tank shall have a separate vent line to the outside.
3. Nameplates: Each tank shall be provided with a nameplate to identify the chemical stored. The nameplates shall be made of US 316 stainless steel, or plastic, have engraved lettering one-inch high, and be mounted on the tank at a location acceptable to the Engineer. The chemical designation to be engraved on the nameplate shall be as specified herein.
4. Certification Plates: A stainless steel or plastic certification plate shall be installed below each storage tank nameplate. The following data shall be included on the certification plate:
   a. Name of tank fabricator.
   b. Date of manufacture.
   c. Product to be stored.
   d. Maximum allowable concentration, specific gravity and temperature of the specified chemical solution that can be stored safely.
   e. Equipment identification number, shown listed herein.
5. Gaskets for nozzles and tank cover flanges shall be supplied by the tank manufacturer and be of a Viton material compatible with the chemical to be stored.
6. Ladders:
   a. Provide ladders for tanks as shown on the drawings. Ladders shall be constructed of FRP. Provide safety cages with ladders. Design ladders to meet OSHA standards: OSHA 2206, 1910.27.
   b. Attach ladders to the tank to allow for tank expansion and contraction due to temperature and loading changes. The mounting system shall be determined by the

ladder material specified and the tank size requested. Connect top ladder mounts to integrally molded-in attachment lugs that allow for tank movement. Ladder mounts may be bolted or banded. Bolted mounts shall consist of a bracket bolted to the tank sidewall with ½-inch encapsulated bolts that allows tank movement without tank or ladder damage. The banded mounts shall consist of a bracket banded to the tank sidewall with 2-inch banding material which allows tank movement without tank or ladder damage. Attach metal ladders to the tank at the top ladder mount location only.

7. Day Tank Scales: Provide chemical scales suitable for the service intended for each day tank where shown on the drawings. The chemical scale shall be of the digital readout/electronic single load cell type. The scale platform shall be sized to accept the tank size for which it is intended and shall be equipped with four (4) adjustable hold down lugs to increase lateral stability. The platform scale coating system shall be a minimum dry thickness of 80 mils and shall be resistant to moisture, chemicals, abrasion, impact, and UV light. Each day tank scale shall be equipped with a 4-20 mA output signal with a remote mounted LCD indicator. The indicator shall be housed in a NEMA 4X, UL approved enclosure with a power requirement of 120 volts. The indicator display shall give the operator the ability to monitor the chemical by weight (lbs) or volume (gallons) and shall display the percent (0-100) of net contents. The indicator shall output net weight via a 4-20mA signal and full scale output shall be user adjustable via the keypad. The indicator shall have four adjustable set points to display low or high level conditions on the indicator. Day tank scales shall be Force Flow Chem-Scale, or approved equal.
8. Manways: Tanks shall be provided with manways and maintenance ports where shown in the Drawings. Manways and maintenance ports shall be molded and threaded with covers screwed into the tank cover not bolted. Manways shall be the maximum diameter available from the tank manufacturer.
9. Leak Detection System: All double walled tanks shall have a leak detection system with sensors mounted in the interstitial space between the inner wall and the outer wall of the storage tank. The leak detection system shall have dry contacts for remote monitoring, status indicator light, an alarm and shall be provided power. All leak detection system components such as sensors, probes, wiring, cables, tubing, indicators, enclosures, etc. shall be compatible with the chemical to be stored.
10. Sight Gauge: Provide a sight gauge support system for bulk storage tanks as shown on the drawings. Supports shall be constructed of FRP.

2.04 SPARE PARTS (NOT APPLICABLE)

2.05 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's product quality control specifics as required for this project.

PART 3 – EXECUTION

3.01 PREPARATION (NOT APPLICABLE)

3.02 INSTALLATION

A. The tanks shall be installed at the locations as indicated on the drawings. The tanks shall be installed in accordance with the fabricator's recommendations, the requirements of the applicable governing standard, and to the satisfaction of the Engineer, and made ready for the installation of piping and other appurtenances as indicated on the drawings and specified under other sections. Grouting under the tank, if required to level the tank support stand, shall be done with non-shrinking grout as specified in Section 03600: Grout.

3.03 ONSITE INSPECTION AND TESTING

A. After completion of installation, the tanks shall be filled with water to the top overflow opening and allowed to stand full for a period of not less than 48 hours. During testing, flanged or threaded connections may be plugged by the installation of temporary blind flanges or threaded plugs on the outside of the tank but shall not be blocked or plugged on the inside. All leaks or indications of leaks shall be repaired by the fabricator and made completely watertight. A leaking tank, upon repair, shall be retested to the satisfaction of the Engineer.

B. Cleaning: When installation has been completed and all connections have been made, all tank surfaces, interior and exterior, shall be thoroughly cleaned as recommended by the fabricator and to the satisfaction of the Engineer. Abrasive cleaning agents shall not be used. The tank and wetted accessories shall be completely dried before being placed into service.

3.04 START-UP AND INSTRUCTION

A. A representative of the manufacturer shall certify in writing that the tank has been installed in accordance with the Manufacturer's recommendations. Certification shall be submitted.

TABLE 13219-A
CHEMICAL STORAGE TANK SCHEDULE

Tank Requirements	Cypress Walk	Orangewood	Hunters Creek	Oak Meadows
Chlorine Bulk Storage Tanks (Double-Walled)				
Quantity	2	2	2	2
Volume per Tank (gal)	1,000	4,400	2,500	3,150
Total Volume (gal)	2,000	8,800	5,000	6,300
Diameter (in)	77	123	96	122
Height (in)	79	123	119	91
Fluoride Bulk Storage Tanks (Double-Walled)				
Quantity	1	1	1	1
Volume (gal)	540	1,000	540	1,000
Diameter (in)	77	77	77	77
Height (in)	48	79	48	79
Fluoride Day Tanks (Single-Walled) – All Water Supply Facilities				
Quantity	1	1	1	1
Volume (gal)	30	30	30	30
Diameter (in)	23	23	23	23
Height (in)	23	23	23	23

Note 1 Bulk tanks must meet volume requirements and dimensional requirements for installation in existing buildings.

END OF SECTION

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SECTION 13300

INSTRUMENTATION AND CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall furnish, install and place into service operating process instrumentation, control systems and panels including accessories, related to this facility, all as shown on plans and specified herein.
   1. Existing plant systems must remain operational during construction, unless approved by the Owner and Engineer. Nighttime and/or other off hours work may be required to support plant operations and shall be included in the Contractor's bid.
   2. The instrument contractor is responsible to "As-Build" all existing control panels and to provide all demolition and modification as necessary for the installation of the new I/O in the existing local control panels.
   3. Equipment rendered obsolete by this construction must be removed from the existing panels. Equipment previously abandoned must also be removed from the panels. Functioning equipment present in these panels must remain functional and will be included on the instrument contractor's "As-Built" drawings. No existing equipment, with the exception of the field wires and panel, may be reused as part of the new control system. New power supplies, surge suppressors, terminal strips, etc. for all I/O to be connected to the new control system must be provided new. The instrument contractor is responsible to provide completed panels that are clean, functional and present a professional appearance.
   4. All wires in control panels must be permanently tagged and shown on the as-built drawings. This includes all spare and abandoned wires and cables. Spare and abandoned cables are to be taped and left coiled in the panels for future use. Cable and wire numbers are to be assigned by the contractor, documented and controlled to prevent duplicate numbers. The Contractor shall turn over to the owner, at the project conclusion, a cable and wire list showing assigned numbers and their physical location in the plant.
   5. See electrical drawings and specifications for additional work required of the instrument contractor as part of this project to supply demolition instructions, relocation and modification instructions for equipment not necessarily shown on the instrument drawings.
   6. Contractor's Integrator shall modify the existing PLC system/program, SCADA screens, and Report generation requirements at the existing Eastern Regional Plant – Control room and the Orange County Main control.
   7. Contractor shall provide travel expenses for FAT period as stated in section 3.01.B.
   8. All instruments and control devices and installation shall comply with Orange County Utilities RAPP documents as applicable.

9. Preliminary and critical software design review meeting shall be conducted by the software engineer/Contractor with Owner and Engineer to insure design compliance with all specification hardware and software requirements as well as the discussion of the preliminary control strategy of the system.

B. Work Includes: Engineering, furnishing, installing, calibrating, adjusting, testing, documenting, starting up, and Owner training for a complete Instrumentation and Control System. Major parts are:
   1. Instrumentation including primary elements, transmitters, and control devices.
   2. Control Panel Modifications.
   3. PLC and I/O Rack Control Panels Modifications.
   4. Software Modifications.
   5. Acceptance Testing, including 30-day system acceptance test.

C. Instrument and Control (I&C) Supplier work scope:
   1. For I&C equipment and ancillaries provide the following:
      a. Completing detail design.
      b. Required Submittals.
      c. Equipment and ancillaries.
      d. Instructions, details, and recommendations to, and coordination with, Contractor for proper installation.
      e. Verify readiness for operation.
      f. Verify the correctness of final power and signal connections.
      g. Adjusting and calibrating.
      h. Starting up.
      i. Testing and coordination of testing.
      j. Training.
   2. Verify following work not by I&C Supplier is provided:
      a. Correct type, size, and number of signal wires with their raceways.
      b. Correct electrical power circuits and raceways.
      c. Correct size, type, and number of I&C related pipes, valves, fittings, and tubes.
      d. Correct size, type, materials, and connection of process mechanical piping for in-line primary elements.
   3. For equipment not provided under I&C Supplier, but directly connected to equipment required by I&C Supplier:
      a. Obtain from Contractor, manufacturer's information on installation, interface, function, and adjustment.
      b. Coordinate with Contractor to allow required interface and operation with I&C System.
      c. For operation and control, verify that installations, interfacing signal terminations, and adjustments have been completed with manufacturer's recommendations.
      d. Test to demonstrate required interface and operation with I&C System.
      e. Examples of items in this category, but not limited to the following:
         1) Valve operators, position switches, and controls.
         2) Chemical feed pump and feeder speed/stroke controls.
         3) Automatic samplers.
         4) Motor control centers.

5) Adjustable speed drive systems.

f. Examples of items not in this category:

1) Internal portions of equipment provided under Division 16, Electrical, that are not directly connected to equipment under I&C System.

2) Internal portions of I&C Systems provided as part of package systems and that are not directly connected to equipment provided under I&C System.

4. Wiring external to equipment provided by I&C Supplier:

a. Special control and communications cable: Provided by I&C Supplier.

5. Signal Verification

a. All proposed and existing control signals shall be verified from field device to the Eastern Regional control room for accuracy and scaling.

b. Furnish testing form to document each signal. Each form shall be signed and sealed by a Florida Registered Professional Engineer

D. Software Engineering work scope:

1. Configuration of PLCs, including:

a. Correct I/O mapping and scaling.

b. Ladder logic implementing defined control strategies.

c. SCADA interface mappings.

d. Specifications/documents including: System External Specification, System Internal Specification, I/O Checklist, Factory Acceptance Test Plan, and Site Acceptance Test Plan.

e. As-built documentation

2. Start-up support, including system testing.

3. System training.

4. Computer-based SCADA system (Proficy iFIX SCADA). Coordinate with Owner for software version requirements and match the current version installed at Eastern Regional Plant. I&C Supplier shall update the local and Eastern Regional Plant graphics, database, and historical reports at the Eastern Regional to support the monitoring and operation of the WSFs.

1.02 SINGLE INSTRUMENT SUPPLIER

A. The Contractor shall assign to the Single Instrument and Control (I&C) supplier full responsibility for the functional operation of all new instrumentation systems. The Contractor shall have said supplier perform all engineering necessary in order to select, to furnish, to program, to supervise installation, connection, to calibrate, to place into operation of all sensors, instruments, alarm equipment, control panels, accessories, and all other equipment as specified herein. The I&C supplier shall have a maintenance office within a 150 mile radius of the project.

B. The single instrument and controls supplier shall demonstrate his or her ability to successfully complete projects of similar sizes and nature. Provide references (including phone number and contact name) for at least three projects successfully completed in which the following tasks were performed: system engineering, documentation including panel assembly, schematics and wiring diagram, programming, field testing, calibration and start-up, operator instruction and maintenance training.

The foregoing shall enable the Contractor and the Owner to be assured that the full responsibility for the requirements of this Section shall reside in an organization which is qualified and experienced in the water management field and its process technology on a functional systems basis.

The single I&C supplier shall have a UL approved shop and shall build all panels according to UL 508A.

Instrumentation and Controls supplier shall be **Curry Controls, Electro Design Engineering or Revere Controls**.

C. The single software engineering supplier shall demonstrate his ability to successfully complete projects of similar sizes and nature. Provide references (including phone number and contact name) for at least three projects successfully completed in which the following tasks were performed: ladder logic programming, computer-based SCADA system configuration, documentation, field testing, start-up, and operator instruction.

1.03 INSTALLATION WORK

A. Nothing in this part of the Specifications shall be construed as requiring the Contractor to utilize personnel supplied by his or her assigned instrument manufacturer's organization, or any division thereof, to accomplish the physical installation of any elements, instruments, accessories or assemblies specified herein. However, the Contractor shall employ installers who are skilled and experienced in the installation and connection of all elements, instruments, accessories and assemblies; portions of their work shall be supervised or checked as specified in Part 3, herein.

1.04 PREPARATION OF SUBMITTAL OF DRAWINGS AND DATA

A. It is incumbent upon the Contractor to coordinate the work specified in these Sections so that a complete I&C system for the facility shall be provided and shall be supported by accurate Shop and record Drawings. As a part of the responsibility as assigned by the Contractor, the Single I&C supplier shall prepare and submit through the Contractor, complete organized Shop Drawings, as specified in Part 2.02, herein. Interface between instruments, motor starters, etc. shall be included in his Shop Drawing submittal.

B. During the period of preparation of this submittal, the Contractor shall authorize direct, informal liaison between his or her Single I&C supplier and the Engineer for exchange of technical information. As a result of this liaison, certain minor refinements and revisions in the systems as specified may be authorized informally by the Engineer, but these shall not alter the scope of work or cause increase or decrease in the Contract Price. During this informal exchange, no oral statement by the Engineer shall be construed to give formal approval of any component or method, nor shall any statement be construed to grant formal exception to or variation from these Specifications.

C. In addition, I&C supplier/programmer shall also provide fully documented version of PLC programming and HMI programming on the CD and hard paper copy.

1.05 ADDITIONAL TECHNICAL SERVICES

A. At no separate additional cost to the Owner, the Contractor shall provide the following services of qualified technical representatives of the Single I&C supplier (See Part 3, herein).
   1. To supervise installation and connection of all instruments, elements, and components of every system, including connection of instrument signals to primary measurement elements and to final control elements such as pumps, valves, and chemical feeders;
   2. To make all necessary adjustments, calibrations and tests; and
   3. To instruct plant operating and maintenance personnel on instrumentation. This time shall be in addition to whatever time is required for other facets of work at the site, and shall be during the Owner's normal working days and hours.

1.06 GUARANTEE

A. The Contractor shall guarantee all equipment and installation, as specified herein, for a period of two (2) years following the date of completion of the work. To fulfill this obligation, the Contractor shall utilize technical service personnel designated by the Single I&C supplier to which the Contractor originally assigned project responsibility for instrumentation. Services shall be performed within four (4) hours after notification by the Owner.

1.07 ADDITIONAL PROVISIONS

A. The applicable provisions of the following Sections under Electrical Work shall apply to work and equipment specified herein, the same as if stated in full, herein:
   1. Codes and Standards
   2. Equipment, Materials and Workmanship
   3. Testing
   4. Grounding
   5. Equipment Anchoring
   6. Conductor and Equipment Identification
   7. Terminal Cabinets and Control Compartments
   8. Process Control Devices

1.08 NEWEST MODEL COMPONENTS

A. All meters, instruments, and other components shall be the most recent field proven models marketed by their manufacturers at the time of submittal of Shop Drawings unless otherwise specified to match existing equipment. All technical data publications included with submittals shall be the most recent issue.

1.09 INSPECTION OF THE SITE AND EXISTING CONDITIONS

A. The instrumentation drawings were developed from past record drawings and information supplied by the Owner.

B. Before submitting a bid, visit the site and determine conditions at the site and at all existing structures in order to become familiar with all existing conditions and instrumentation and control systems which will, in any way or manner, affect the work required under this Contract. No subsequent increase in Contract cost will be allowed for additional work required because of the Contractor's failure to fulfill this requirement.

1.10 RELATED WORK

A. Division 16: Electrical.

B. Division 11: Equipment.

C. Division 13: Special Construction.

PART 2 – PRODUCTS

2.01 INSTRUMENTATION CRITERIA

A. Designation of Components: In these Specifications and on the Drawings, all systems, meters, instruments, and other elements are represented schematically, and are designated by numbers, as derived from criteria in Instrument Society of Automation Standard ANSI/ISA S5.1-1973. The nomenclature and numbers designated herein and on the Drawings shall be employed exclusively throughout Shop Drawings, data sheets, and similar materials. Any other symbols, designations, and nomenclature unique to the manufacturer's standard methods shall not replace these prescribed above, used, herein and on the Drawings.

B. Signal Characteristics: Signals shall be electrical, as indicated herein, and shall vary in direct linear proportion to the measured variable, except as noted. Electrical signals outside control panel(s) shall be 4 to 20 milliamperes DC, except as noted. Signals within enclosures may be 1-5 volts DC.

C. Matching Style, Appearance And Type: All instruments to be panel mounted at the control panels shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be of one (1) manufacturer.

D. Accuracy And Repeatability: The overall accuracy of each instrumentation system or loop shall be as prescribed in the Specifications for that system or loop. Each system's accuracy shall be determined as a probable maximum error; this shall be the square-root of the sum of the squares of certified "accuracy s" of certain designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual electronic instrument shall have a minimum accuracy of $\pm$0.7 percent of full scale and a minimum repeatability of $\pm$0.4 percent of full scale unless otherwise specified. Instruments which do not conform to or improve upon these criteria are not acceptable.

E. Signal Isolators, Converters And Power Supplies: Signal isolators shall be furnished and installed in each measurement and control loop, wherever required, to insure adjacent component impedance match or where feedback paths may be generated. Signal converters shall be included where required to resolve any signal level incompatibilities. Signal power supplies shall be included, as required by the manufacturer's instrument load characteristics, to insure sufficient power to each loop component.

F. Alternative Equipment Or Methods: Equipment or methods requiring redesign of any project details are not acceptable without prior approval of the Engineer. Any changes inherent to a proposal alternative shall be at no additional cost to the Owner. The required approval shall be obtained in writing by the I&C Subcontractor through the Contractor prior to submittal of Shop Drawings and data. Any proposal for approval of alternative equipment or methods shall include evidence of improved performance, operational advantage and maintenance enhancement over the equipment or method specified, or shall include evidence that a specified component is not available. Otherwise, alternative equipment (other than direct, equivalent substitutions) and alternative methods shall not be proposed.

2.02 DETAILED SYSTEMS DRAWINGS AND DATA

A. Content: The Contractor shall submit detailed Shop Drawings and data prepared and organized by the Single I&C supplier designated at the time of bidding. The quantity of submittal sets required shall be six (6). These Drawings and data shall be submitted as a complete bound package at one time within 80 calendar days after date of Notice to Proceed and shall include:
   1. Drawings showing definite diagrams for every instrumentation loop system. These diagrams shall show and identify each component of each loop or system using legend and symbols from ISA Standard S5.4, each having the format of ISA Standard S5.1 as used on the Project Drawing. (Each system or loop diagram shall be drawn on a separate Drawing sheet.)
   2. Data sheets for each component, together with a technical product brochure or bulletin. The data sheets shall show:
      a. Component function description used herein and on the Drawings;
      b. Manufacturer's model number or other product designation;
      c. Project tag number used herein and on the Drawings;
      d. Project system loop of which the component is a part;
      e. Project location or assembly at which the component is to be installed;
      f. Input and output characteristics;
      g. Scale range and units (if any) and multiplier (if any);
      h. Requirements for electric supply (if any);
      i. Requirements for air supply (if any);
      j. Materials of component parts to be in contact with, or otherwise exposed to, process media;
      k. Calibration curves as required;
      l. Special requirements or features.

A complete index shall appear in the front of each bound submittal volume. A separate technical brochure or bulletin shall be included with each instrument data sheet. The data sheets shall be indexed in the submittal by systems or loops, as a separate group for each system or loop. If, within a single system or loop, a single instrument is employed more than once, one data sheet with one brochure or bulletin may cover all identical uses of that instrument in that system. Each brochure or bulletin shall include a list of tag numbers for which it applies. System groups shall be separated by labeled tags.

3. Drawings showing both schematic and wiring diagrams for control circuits. Complete details on the circuit interrelationship of all devices within and outside each control panel shall be submitted first, using schematic control diagrams. Subsequent to return of this first submittal by the Engineer, piping and wiring diagrams shall be prepared and submitted for review by the Engineer; the diagrams shall consist of component layout Drawings to scale, showing numbered terminals on components together with the unique number of the wire to be connected to each terminal. Piping and wiring diagrams shall show terminal assignments from all primary measurement devices, such as flow meters, and to all final control devices, such as samplers, pumps, valves, and chemical feeders. The Contractor shall furnish all necessary equipment supplier's Shop Drawings to facilitate inclusion of this information by the I&C system supplier. Schematic and wiring diagram criteria shall be followed as established in NEMA Standards Publication ANSI/NEMA 1CS-1-1978, "Industrial Control and Systems."
4. Assembly and construction Drawings for each control panel and for other special enclosed assemblies for field installation. These Drawings shall include dimensions, identification of all components, surface preparation and finish data, nameplates, and the like. These Drawings also shall include enough other details, including prototype photographs, to define exactly the style and overall appearance of the assembly; a finish treatment sample shall be included.
5. Installation, mounting and anchoring details for all components and assemblies to be field-mounted, including conduit connection or entry details.
6. Complete and detailed bills of materials. A master Bill of Materials listing all field mounted devices, control panels and other equipment that shall be shipped to the job site. A Bill of Materials for each control panel listing all devices within the panel.
7. Modifications to existing equipment. A complete description of all proposed modifications to existing instrumentation equipment, control panels, control devices, cabinets, etc., shall be submitted with the Shop Drawings complete with detailed Drawings of the proposed modifications.

B. Organization And Binding: The organization of initial Shop Drawing submittal required above shall be compatible to eventual inclusion with the Technical Manuals submittal and shall include final alterations reflecting "as built" conditions. Accordingly, the initial multiple-copy Shop Drawing submittal shall be separately bound in 3-ring binders of the type specified under Part 2.03, herein, for the Technical Manuals.

2.03 TECHNICAL MANUALS

A. Five (5) final sets of technical manuals shall be supplied for the Owner, and one (1) final set shall be supplied for the Engineer, as a condition of acceptance of the project. Each set shall consist of one (1) or more volumes, each of which shall be bound in a standard size, three-ring, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 3.0 inches.

B. Initially, two (2) sets of these manuals shall be submitted to the Engineer for favorable review after return of favorably reviewed Shop Drawings and data required under Part 3, herein. Following the Engineer's review, one (1) set shall be returned to the Contractor with comments. The sets shall be revised and/or amended as required and the requisite final sets shall be submitted to the Engineer fifteen (15) days prior to start-up of systems. The Engineer shall distribute the copies.

C. In addition to updated Shop Drawing information to reflect actual existing conditions, each set of technical manuals shall include installation, connection, operating, trouble-shooting, maintenance, and overhaul instructions in complete detail. This shall provide the Owner with comprehensive information on all systems and components to enable operation, service, maintenance, and repair. Exploded or other detailed views of all instruments, assemblies, and accessory components shall be included together with complete parts lists and ordering instructions.

2.04 SPARE PARTS

A. The Contractor shall include, as part of the bid package, a list of recommended spare parts covering items required under Section 13300 except PLC’s of these Specifications. The total price of these spare parts shall not be less than $5,000.00 and this sum shall be a part of the Contractor's total bid price. PLC spare parts are covered in the PLC section of this Specification, and the $5,000.00 cited above shall be in excess of the PLC spare parts as listed in 2.08 this specification. The Single I&C Supplier in fact shall be responsible for delivery of the spare parts, as directed by the Owner after plant start-up. Prior to delivery of the spare parts, the Owner shall have the option of adding or exchanging any originally enumerated component based on current list prices for each item. The Contractor shall also submit a list of recommended equipment for maintaining and calibrating equipment furnished under Section 13300.

B. The Single I&C supplier in fact shall be responsible for delivery of the spare parts, as directed by the Owner either during or after start-up. Prior to delivery of the spare parts, the Owner shall have the option of adding or exchanging any originally enumerated component based on current list prices for each item.

2.05 CONTROL PANELS

A. General: Control panels shall be modified to include the following:
   1. Fill Panel 120VAC UPS power supply
   2. Emergency shower or eyewash in use.

B. Signal And Control Circuit Wiring:
   1. Wire Type and Sizes: Conductors shall be flexible stranded copper wire; these shall be U.L. listed Type THHN and shall be rated 600 volts. Wire for control signal circuits and alarm input circuits shall be 16 AWG. All instrumentation cables shall be shielded No. 20 AWG with a copper drain wire. All special instrumentation cable such as between sensor and transmitter shall be supplied by the I&C supplier.
   2. Wire Insulation Colors: Conductors supplying 120 volt AC power on the line side of a disconnecting switch shall have a black insulation for the ungrounded conductor. Grounded circuit conductors shall have white insulation. Insulation for ungrounded 120 volt AC control circuit conductors shall be red. All wires energized by a voltage source external to the control board(s) shall have yellow insulation. Insulation for all DC conductors shall be blue.
   3. Wiring Installation: All wires shall be run in plastic wireways except (1) field wiring, (2) wiring run between mating blocks in adjacent sections, (3) wiring run from components on a swing-out panel to components on a part of the fixed structure, and (4) wiring run to panel mounted components. Wiring run from components on a swing-out panels to other components on a fixed panel shall be made up in tied bundles. These shall be tied with nylon wire ties, and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at terminals. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon wire ties and secured to the inside face of the panel using adhesive mounts. Wiring to rear terminals on panel mount instruments shall be run in plastic wireways secured to horizontal brackets run above or below the instruments in about the same plane as the rear of the instruments. Shields of shielded instrument cable shall only be grounded on one side of each cable run. The side to be grounded shall always be in the field as applicable. Care shall be exercised to properly insulate the ungrounded side, to prevent ground loops from occurring. Conformance to the above wiring installation requirements shall be reflected by details shown on the Shop Drawings for the Engineer's review.
   4. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all Shop Drawings. These numbers shall be marked on all conductors at every terminal using permanently marked heat-shrink plastic. Instrument signal circuit conductors shall be tagged with unique multiple digit numbers. Black and white wires from the circuit breaker panelboard shall be tagged including the one (1) or two (2) digit number of the branch circuit breaker.
   5. Terminal Blocks: Terminal blocks shall be molded plastic with barriers and box lug terminals, and shall be rated 15 amperes at 600 volts. White marking strips, fastened securely to the molded sections, shall be provided and wire numbers or circuit identifications shall be marked thereon with permanent marking fluid. Terminal blocks shall be General Electric Type CR 151A1 with mounting rack, equivalent by Cinch-Jones or equal.

C. PLC Control Panel Requirements: All input/output hardware and interface equipment shall be provided by the computer & PLC system supplier for all specified inputs and outputs. Input/output hardware shall be plug-in modules (or equivalent I/O assembly and associated printed circuit board) in associated I/O rack assemblies.

Signal and control circuitry to individual input/output modules shall be arranged such that any one module failure shall not disable more than one control loop within any group of controlled equipment (eg. one pump out of a group of three pumps, etc.) The latest revision of the programming software shall be installed as of substantial completion.

All analog and discrete inputs and outputs shall be optically or transformer isolated for voltage surge protection and shall meet peak common mode and 3 kV surge to ground withstand capability (SWC) test as specified by ANSI C37.90A197A (IEEE Standard 472-1974).

In the event a standard manufacturers product does not satisfy the above surge requirements, additional protective circuitry to suppress contact bounce and to protect transients from being recognized as data. Input/output modules shall be configured for ease of wiring and maintenance. The modules shall be connected to wiring arms which are movable to permit removal of a module without disturbing field wiring. Covers shall be provided to prevent operator personnel from inadvertently touching the terminals. PLC shall be a standard Quantum using ladder logic and NOE module. Latest firmware shall be installed on the processor. Input/output modules shall have individual indicators that show the on/off status of each input or output device connected to it.

1. Analog Input: The analog input subsystem shall accept 4-20 MA (1-5 volts across 250 ohms) signals which shall be multiplexed into one or more amplifiers and ADC's by one or more analog input multiplexers. The analog input multiplexers shall be of the solid state differential type and shall employ successive approximation or dual slope integration to digitize the sampled analog signals into a 12 bit binary value; with an accuracy of $\pm$0.05% of full scale. Input power supply shall be 24 volts DC from the I/O power supply subsystem where power is not supplied by the associated field instrument.
2. Discrete Input: Dry Contact: The input subsystem shall sense the open or closed status of contacts at each scan interval. Sensing power shall be 24 volts DC from the I/O power supply subsystem. Powered input: The input subsystem shall sense the status of 120VAC inputs at each scan interval. Power for inputs is derived from the source system or equipment. Coordinate with Owner and other drawings for the requirements of either dry contact or powered input and provide accordingly.
3. Analog Output: The analog output subsystem shall accept incremental signals from the process controller. A solid state digital to analog converter (DAC) shall be provided for each analog output. The incremental signals from the process controller shall increment or decrement the 4-20 MA output signal from each DAC. A 24 volt DC power supply shall be provided for analog outputs from the I/O power supply subsystem. The output of each DAC shall be continuously maintained and shall have a drift rate no greater than 2% in 24 hours. Each DAC shall have a 12 bit resolution and an accuracy of $\pm$0.05% full scale.
4. Discrete Output: The discrete output subsystem shall be of the solid state type and shall generate maintained or momentary outputs as required to operate interposing relays provided in related circuitry. Diode protection (in addition to surge protection) shall be provided on all discrete outputs. The output contacts shall be rated 24 VDC/120 VAC, 5A SPDT. Match Orange County standard for discrete output (120VAC).

5. Power Supplies: Input/output (I/O) subsystem power supplies shall be provided for each PLC control panel and shall be sized to power all 2-wire and 4-wire discrete and analog DC circuits under full-load conditions including allowances for specified spares. The incoming power source to the I/O subsystem power supplies shall be 115 VAC from the associated panelboard. Transformation, rectification and smoothing circuitry shall be furnished to provide a regulated 24 volt DC power supply. The DC power supply shall be converted to other DC voltage levels as required. Provide 24VDC power supply with diode protection and alarm (PLC input) in case of power supply failure, if shown on drawings.

2.06 ACCESSORIES

A. General purpose relays in the control panels shall be plug in type with contacts rated 10 amperes at 120 volts AC and LED indicator. The quantity and type of contacts shall be as shown on the Drawings. Each relay shall be enclosed in a clear plastic heat and shock resistant dust cover. Sockets for relays shall have screw type terminals. Relays shall be Potter and Brumfield Type KRP or KUP, Square-D Type K, or equal.

B. Time delay relays shall be solid state on-delay or off-delay type with contacts rated 10 amperes at 120VAC. Units shall include adjustable dial with graduated scale or digital switch setting covering the time range in each case. Time delay relays shall be Agastat Series 7000, Omron series H3, SSAC type TDM or approved equal.

C. Additional slave relays shall be installed when the number or type of contacts shown exceed the contact capacity of the specified relays and timers.

D. All indication lights shall be LED type, round 22 mm (minimum) configuration, heavy duty and corrosion resistant type. Non-LED type indication lights are not acceptable. Switches shall be round 30.5mm configuration, heavy duty and corrosion resistant. Legend plate shall be standard size square style laminate with white field and black markings as shown. LED Indicating lights shall have integral transformer for operation from 120VAC, if necessary. Pushbuttons shall include full guard with flush button and selector switches shall include a black non-illuminated knob on switch, unless otherwise noted. Contact arrangement and configuration shall be as shown. Devices shall be Cutler Hammer Type E-30, General Electric Type CR104, Square D class 9001 type Sk, Allen Bradley Bulletin 800 or equal.

E. Selector switches shall be of the rotary type with the number of positions as shown on the Drawings. Color, escutcheon engravings, contact configurations and the like shall be as shown. Devices shall be Cutler Hammer Type E-24, General Electric Type CR104, or equal.

F. Circuit breakers shall be single pole, 120 volt, 15 ampere rating or as required to protect wires and equipment and mounted inside the panels as shown.

G. Nameplates shall be supplied for identification of all field mounted elements, including flow meters and their transmitters. These nameplates shall identify the instrument, or meter, descriptively, as to function and system. These nameplates shall be fabricated from black-face, white-center, laminated engraving plastic. A nameplate shall be provided for each signal transducer, signal converter, signal isolator, each electronic trip, and the like, mounted inside the control panels. These shall be descriptive, to define the function and system of such element. Adhesives shall be acceptable for attaching nameplates. Painted surfaces must be prepared to allow permanent bonding of adhesives. Nameplates shall be provided for instruments, function titles for each group of instruments and other components mounted on the front of the control panels as shown. These nameplates and/or individual letters shall be fabricated from VI-LAM, Catalog No. 200, manufactured by N/P Company, or equivalent by Formica, or equal. Colors, lettering, style and sizes shall be as shown or as selected by the Engineer.

H. Solenoid Valves if not otherwise noted shall be globe valve directly actuated by solenoid and not requiring minimum pressure differential for operation. Materials shall be brass globe valved bodies and Buna-N valve seats. The size shall be ¼-inch normally closed. The coil shall be 115 VAC coil, Nema 4 solenoid enclosure. Manufacturer shall be ASCO; Red Hat, or equal.

2.07 SURGE PROTECTIVE DEVICE (SPD) FOR SURGE PROTECTION

A. General: Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be maintenance free and self-restoring. Instruments shall be housed in a suitable case, properly grounded. Ground wires for all TVSS shall be connected to a good earth ground and where practical, each ground wire run individually and insulated from each other. These protectors shall be mounted within the instrument enclosure or a separate NEMA 4X junction box coupled to the enclosure.

B. Power Supply: Protection of all 120 VAC instrument power supply lines shall be provided. Control panels shall be protected by line noise suppressing isolation transformers and surge. Field instruments shall be protected by SPD. For control panels, the line noise suppressing isolation transformer shall be Topaz Series 30 Ultra isolators or approved equal. The suppressor shall be Edco HSP-121, Surge Suppression Incorporated, Current Technology, or Joslyn.

C. Analog Signals: Protection of analog signal lines originating and terminating not in the same building shall be provided by SPD. For analog signal lines the SPD shall be Edco PC-642. For field mounted two-wire instruments the SPD shall be encapsulated in stainless steel pipe nipples, and shall be Edco SS64 series, Phoenix, MTI, or DEHN pipe series. For field mounted four-wire 120VAC instruments, the SPD shall be in a NEMA 4X polycarbonate enclosure, Edco SLAC series, Phoenix, MTI, or DEHN.

2.08 INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATIONS

A. Level Element and Transmitter (Ultra-Sonic)

1. The multi-purpose sonic level system shall operate on the principle of ultrasonic sonar reflection in which acoustic impulses emitted from an ultrasonic transducer are reflected back from the material surface and are received by the transducer. The transit time of pulse travel from generation to echo is measured. The elapsed time is proportional to the distance between the transducer face and material surface. Systems shall be designed for automatic self-compensation of signal speed due to temperature, humidity and other atmospheric variations. The system shall be supplied with interconnecting cable between sensor and transmitter.
2. Transmitter Design:
    a. Microprocessor-based echo-time measuring transmitter with output signal proportional to distance between sensor and surface of media. The controller shall have an EEPROM memory and shall not require a battery to ensure protection of stored data.
    b. Modular component assembly construction with plug-in electronics for convenient service.
    c. Power: 120 VAC. 60 Hz, 17-Watt maximum power requirements (36-VA).
    d. Isolated 4-20 mA DC output signal into 750 ohms.
    e. Operation range and engineering unit selections with local digital display of measured distance shall be able to enter new data via infrared keypad.
    f. Accuracy: +/-0.25 percent of full scale.
    g. Resolution: +/-0.1 percent of full scale.
    h. Distance: Maximum allowable distance between sensor and transmitter is 1200 feet. Coordinate with Electrical Contractor and contract drawings for distance requirements and provide accordingly.
    i. Total Beam Angle: 6 degrees or less.
    j. Maximum Range: 0 to 50 standard feet.
    k. Process: Level of finished water in storage tank.
    l. Sensor Location Temperature: -40 to 203 degree F.
    m. Transmitter Ambient Temperature: -5 to 122 degree F.
3. The multipurpose sonic level system shall have internal self-diagnostics function and 6 alarm relays for lost echo or temperature, rate of change of level, differential level, time sampling, volume sampling, and pump control. Systems shall be furnished complete with flanged transducer, interconnection cable and indicating transmitter.
4. The transmitter shall include an integral LCD type indicator calibrated in engineering units for local indication. LCD display shall be minimum 100 x 40 mm (4 x 1.5”) multi-field back lit LCD display with individual alarm status lights on LCD display.
5. Provide a hand held keypad programmer or calibrator for startup.
6. Unless shown otherwise on the instrument schedule, provide NEMA 4X corrosion resistant, oil tight, dust tight, and weatherproof housing for indoor or outdoor locations.
7. Provide all stainless steel mounting hardware for surface, panel or handrail mounting as required by location.
8. For outdoor application, provide and install transmitter in a NEMA 3R enclosure that has front mounted visible data display behind clear, shatterproof viewing cover.

9. Systems shall be Manufactured by Siemens-Milltronics Model Hydroranger 200 with an Echomax XPS-15 transducer. Transducer material shall be suitable for chlorine and fluoride liquid or vapor.

2.09 CONTROL STRATEGY SCHEDULES

The control strategies are written descriptions of the programming required to implement regulatory and sequential control of the unit processes. Control strategies shall fully reside in the memory of the designated PLC. Coefficients pertaining to control strategies shall be modifiable through the operator interface in the monitoring / control mode. I&C supplier shall obtain the existing PLC programs of the each facility chemical feed pumps control system and mimic the new control system with additional control features stated below.

The I&C supplier shall include an additional 160 hours on-site to fine tune control systems and make minor software modifications in order to resolve any logic discrepancies encountered during start-up, and supply the Owner with a complete functional system. This shall be part of the bid package with no additional cost to the owner.

A. Control Strategy: Hydrofluorosilicic Acid Control: PLC program shall have a preset ratio (adjustable) control logic for Hydrofluorosilicic acid feed pump. The PLC logic shall turn on the acid feed pump based on the preset ratio setpoint and the number of well running. The PLC logic shall have a trimming option based on the Fluoride measurement and shall be able to enable or disable the trimming option via HMI screen. The PLC program shall have a pushbutton “acid control enable/disable” on the HMI screen. To ensure the safety and opening of the manual value, the backup Hydrofluorosilicic acid feed pump shall be controlled manual via HMI screen.

   Sodium Hypochlorite Control: PLC program shall have a preset ratio (adjustable) control logic for Sodium Hypochlorite feed pump No.1 & 3 (pre-disinfection metering pumps). The PLC logic shall turn on the Sodium Hypochlorite feed pump or pumps (depending on tank in operation selection) based on the preset ratio setpoint. The PLC logic shall have a trimming option based on the chlorine measurement from respective chlorine analyzer. If both ground storage tanks are in operation (see below for ground storage tank selection), the PLC logic shall monitor the average value of the two chlorine analyzers and adjust the speed of feed pumps. If only one tank is in operation, PLC logic shall only monitor the associated analyzer for trimming control.

B. General Logic Description:
   1. Auto-Manual Start-Stop scheme for all equipment (pump or valves) shall operate on the following way: Any equipment shall have Auto and Manual mode selectable from the HMI screen. In Auto mode the particular pump or valve shall follow the auto control strategy described above. In Manual mode, operator shall be able to Start, Stop, Open or Close pump/ Valve from the HMI screen. VFD pump or modulating valve shall have in addition the manual set point for speed/ position.
   2. The control system shall be designed to allow online calibration and repair of instruments used in the plant control scheme without disruption of the plant process or production rate. This shall be accomplished using operator selectable process hold

values in conjunction with operator selectable hold timers and alarms to remind operators to reset the system to active inputs.

3. All alarms that are generated by the PLC and have active role in PLC logic, shall be latched, and shall be resetable from the HMI screens, except the alarms that need to be reset on the field.
4. All alarms that are generated by the PLC and have only monitoring purposes, shall be present only while the conditions that caused the alarm are present, and be automatically reset when the conditions are no longer present.
5. All alarms generated by the PLC shall have selectable value in HMI for alarm set point, and selectable time delay.
6. All flow pacing controls (or pacing controls of any kind) shall include a ratio factor that can be entered from the screens. Also, PLC programmer shall leave the option of adding calculation blocks for all pacing controls as required during the startup.
7. All Set points for PID loops shall be enterable from the screen together with percentage that PLC shall use to calculate stage up and stage down set points. That calculation shall be one scan operation. After that one scan operation initiated by either entering the PID set point or percentage, operator shall be able to overwrite calculated values from the screen

2.10 INSTRUMENT LIST

TAG NO.	COMPONENT CODE	COMPONENT TITLE	COMPONENT OPTIONS	REMARKS
LE/LIT-0401	L1	Sodium Hypochlorite Tank#1 Level	0-10.5 feet	
LE/LIT-0402	L1	Sodium Hypochlorite Tank#2 Level	0-10.5 feet	
LE/LIT-0501	L1	Hydrofluosilicic Acid Tank Level	0-7 feet	

WT-0502		Hydrofluosilicic Acid Day Tank weight	0-600 lb	Provided by specification 13219.

2.11 PROGRAMMING SOFTWARE

A. The Contractor is responsible for using the PLC programming software (Proworx 32) with the same version that the County is currently using for the PLC type specified under specification 13300. No PLC software license is required for this project for the Owner.

B. The Contractor shall supply full developmental key and license for Proficy iFIX SCADA software for new PLC control panel HMI/SCADA workstation.

C. Furnish and install new local IFIX computer at each facility. Remove existing panel mounted computer and install a Windows 7 professional workstation within the enclosure with raid one capability. Include a Dell 24 inch U2412M in each PLC enclosure. Install and configure current version of IFIX used at Eastern Regional. Provide license support and computer warranty for three years. Supply Microsoft Office on computer and Symantec endpoint additional node license.

PART 3 – EXECUTION

3.01 INSTALLATION, CALIBRATION, TESTING, START-UP AND INSTRUCTION

A. General: Under the supervision of the Single I&C supplier, all systems specified in this Section shall be installed, connected, calibrated and tested, and in coordination with the Engineer and the Owner, shall be started to place the processes in operation. This shall include final calibration in concert with equipment specified elsewhere in these Specifications, including pumps, valves, as well as certain existing equipment.

B. Testing: All systems shall be exercised through operational tests in the presence of the Engineer in order to demonstrate achievement of the specified performance. Operational tests depend upon completion of work specified elsewhere in these Specifications. The scheduling of tests shall be coordinated by the Contractor among all parties involved so that the tests may proceed without delays or disruption by incomplete work.
   1. Unwitnessed Factory Test (UFT): An unwitnessed factory test shall be conducted to prepare the I&C Supplier to demonstrate compliance with this specification during the Factory Acceptance Test (FAT). The I&C Suppler shall prepare a written procedure detailing every aspect of the UFT. This procedure must be submitted to the ENGINEER for approval prior to the commencement of the UFT. This procedure along with any forms generated during the UFT shall comprise the basis of the FAT.

The I&C Supplier shall inspect and test the Integrated Control System (ICS) to ensure it is ready for the FAT. This test shall take place at the I&C Supplier's factory. It shall consist of interconnecting computers, PLC control panels, communications links, and other new Control Panels (unless specifically excluded below). All primary element inputs shall be simulated (inputs shall be adjustable by switch, if discrete; by potentiometer or similar device, if analog). Primary outputs shall be monitored via output devices (LED indication lights, for discrete; a meter, digital display (12-bit min. resolution)or other such analog device, if analog output).

During the UFT, the Contractor shall test the communications links and demonstrate error-free communications to and from each node on the fiber optic network. Verify that each I/O point is consistently mapped at the computer node, at the PLC I/O card, in the PLC memory, and at the I/O simulated device according to the database provided by the software engineer. Verify the proper operation of each of the pilot devices on each of the control panels, if any.

2. Excluded New Panels: None

3. Factory Acceptance Test (FAT): The I&C Supplier shall test the entire control system. The test shall take place at the I&C Supplier's factory. The I&C Supplier shall simulate all inputs and outputs as performed in the UFT. The software engineer shall load application programs into each PLC. The software engineer shall load the HMI application into the computer. Owner and Owner's Consultant will participate and witness in FAT. Provide a minimum of 2 weeks' notice to the Owner/Engineer before conducting testing. I&C Supplier shall provide all expenses for Owner and Engineer at the FAT. Prior to commencement of the FAT, the I&C Supplier shall furnish the following documentation to the Engineer:

a. All Drawings, Specifications, Addenda, and Change Orders
b. Master copy of the written FAT procedures
c. List of equipment to be tested
d. Shop drawings of equipment to be tested
e. Preliminary Software documentation submittal

Daily Schedule for FAT:

a. Begin each day with a meeting to review the day's test schedule
b. End each day with a meeting to review the day's test results and to review and to revise the next day's test schedule, if required.

The I&C Supplier shall repeat the I/O point mapping consistency check as before, with the addition of verification of mapping on HMI screens. Those variables, which are not I/O but are variables which exist in the PLC and HMI software only (see preliminary software documentation), shall all be checked. Check the function of each loop, including set points, alarms, displays, and operator interface. Check all loops. Check data logging, alarm logging, and event logging. Test all non-loop-specific functions including, but not limited to the following:

a. Demonstrate capacity of system for expansion. Include tests for both storage capacity and processing capacity.
b. Include tests for timing requirements.
c. Demonstrate online and offline diagnostic tests, procedures and displays.
d. Demonstrate Failure Mode and Backup Procedures: Power failure, auto restart, disk backup and reload, retentive outputs.

Correct deficiencies found and complete correction of deficiencies prior to shipment to site. Failed Tests shall be repeated and witnessed by the Owner and Engineer. With approval of the Engineer or Owner certain tests may be conducted by the I&C Supplier and Witnessed by the Engineer and Engineer during START-UP. I&C supplier shall include in his or her bid allowance for travel expenses for 3 persons (2 from Owner, and 1 Engineer) for entire system FAT – duration maximum 5 days. Travel expenses shall include car rental, accommodation and food for each person during FAT period. See section 3.02 supplements for sample "Loop Status Report" and "Functional Acceptance Test Sheet".

C. Installation And Connection:
   1. The Contractor shall install and connect all field-mounted components and assemblies under the criteria imposed in Part 1, 1.03, herein. The installation personnel shall be provided with a final reviewed copy of the Shop Drawings and data.
   2. The instrument process sensing lines and air signal tubing shall, in general, be installed in a similar manner to the installation of conduit specified under Section 16100. Individual tubes shall be run parallel and near the surfaces from which they are supported. Supports shall be used at intervals of not more than 3 feet of rigid tubing.
   3. Bends shall be formed with the proper tool and to uniform radii and shall be made without deforming or thinning the walls of the tubing. Plastic clips shall be used to hold individual plastic tubes parallel. Ends of tubing shall be square cut and cleaned before being inserted in the fittings. Bulkhead fittings shall be provided at all panels.
   4. The Contractor shall have a technical field representative of the I&C supplier to instruct these installation personnel on any and all installation requirements; thereafter, the technical field representative shall be readily available by telephone to answer questions and supply clarification when needed by the installation personnel.
   5. Where primary elements (supplied by I&C supplier) shall be part of a mechanical system, the I&C supplier shall coordinate the installation of the primary elements with the mechanical system manufacturer.
   6. Finally, after all installation and connection work has been completed, the technical field representative shall check it all for correctness, verifying polarity of electric power and signal connections, making sure all process connections are free of leaks, and all such similar details. If the initial inspection finds no deficiencies, the technical field representative shall proceed to the certification to the Contractor. Any completed work that is found to have deficiencies shall have those deficiencies corrected by installation personnel at no additional cost to the Owner. The technical field representative shall then recheck the work after the identified deficiencies are corrected. If the technical field representative finds deficiencies in the follow-up inspection, then remedial action shall be taken by the Contractor at no cost to the Owner. This pattern shall be repeated until the installation is free from defect. The technical field representative shall then certify in writing to the Contractor that for each loop or system that he has inspected is complete and without discrepancies.
   7. The field representative of the Single I&C supplier shall coordinate all work required to interface the new equipment and control devices with the existing equipment, including all required modifications to existing equipment and related devices.

D. Calibration:
   1. All instruments and systems shall be calibrated after installation, in conformance with the component manufacturer's written instructions. This shall provide that those components having adjustable features are set carefully for the specific conditions and applications of this installation, and that the components and/or systems are within the specified limits of accuracy. Defective elements which cannot achieve proper calibration or accuracy, either individually or within a system, shall be replaced. This calibration work shall be accomplished by the technical field representatives of the I&C system supplier who shall certify in writing to the Contractor that for each loop or system all calibrations have been made and that all instruments are ready to operate. See section 3.02 supplements for sample "Instrumentation Calibration Sheet".
   2. Proof of Conformance -The burden of proof of conformance to specified accuracy and performance is on the Contractor using its designated Single I&C supplier. The Contractor's designer shall supply necessary test equipment and technical personnel if called upon to prove accuracy and/or performance, at no separate additional cost to the Owner, wherever reasonable doubt or evidence of malfunction or poor performance may appear within the guarantee period.

E. Pre-Commissioning: The I&C Supplier shall test each loop (discrete and analog) to determine if it is functioning correctly. The I&C Supplier shall furnish a loop sheet for each loop to be tested. The loop sheet shall represent the actual “as-built” condition of the loop. The I&C Supplier shall perform a field functional loop test which shall be witnessed by the Engineer and Owner. If the loop fails the functional test, the I&C Supplier shall coordinate repairs for the Contractor to correct whatever is wrong with the loop. The I&C Supplier shall retest the loop until it is approved. Each loop shall be tested and approved by Engineer and Owner until all loops have been approved.

F. Start-Up And Instruction: When all systems are assessed by the Contractor to have been successfully carried through complete operational tests with a minimum of simulation, and the Engineer concurs in this assessment, plant start-up by the Owner's operating personnel can follow. For a minimum of three times for (4) hours prior to start-up, operating and maintenance personnel shall be instructed in the functions and operation of each system and shall be shown the various adjustable and set point features which may require readjustment, resetting or checking, re-calibration or maintenance by them from time to time. This instruction shall be scheduled at a time arranged with the Owner at least two (2) weeks in advance. Instruction shall be given by qualified persons who have been made familiar in advance with the systems. All equipment shall be checked during the first year of operation at intervals of three months for a period of not less than one day or as may be required to correct any defects to the satisfaction of the Owner.

G. Modifications To Existing Facilities: The Contractor shall make all modifications to existing equipment and control devices which are required to successfully install and integrate all new instrumentation equipment. All costs for any required modification and rehabilitation effort shall be included in the Contractor's original bid amount and no additional payment shall be allowed.

H. Plant Shutdowns: The Single I&C supplier shall carefully examine all work to be performed relative to existing I&C equipment and the installation of new equipment and control devices. Work shall be scheduled to minimize required plant shutdown times.

I. Coordination With Other Concurrent Projects: The single I&C supplier shall coordinate extensively with other I&C suppliers of concurrent projects. Some of the equipment shown in this contract as existing might be installed while this contract is underway.

3.02 TRAINING

A. General:
   1. Provide an integrated training program to meet specific needs of Owner's personnel.
   2. Provide instruction on one working shift as needed to accommodate the Owner's personnel schedule.
   3. Owner reserves the right to make and reuse video tapes of training sessions if applicable.

B. Operations and Maintenance Training:
   1. Include a review of O&M manuals, expendables, and test equipment.
   2. Training session duration shall be minimum 4 hours. Provide training schedule with outlines at least one week before the training to the Owner.
   3. Training shall include a minimum understanding of loop functions, loop operation, component calibration, adjustments such as controller tuning, switch trip point, etc., and periodic maintenance.

3.03 SUPPLEMENTS

A. Supplements listed below shall be provided by the Integrator.
   1. Instrumentation Calibration Sheet
   2. Loop Status Report
   3. Functional Acceptance Test Sheet

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DIVISION 14
CONVEYING SYSTEMS (NOT USED)

DIVISION 15
MECHANICAL

SECTION 15000

MECHANICAL-GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. All equipment furnished and installed under this contract shall conform to the general stipulations set forth in this Section except as otherwise specified in other sections.
   2. Contractor shall coordinate all details of equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alternations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

B. Related Work Described Elsewhere:
   1. General Requirements: Division 1
   2. Concrete: Division 3
   3. Metals: Division 5
   4. Painting: Division 9
   5. Equipment: Division 11
   6. Special Construction: Division 13
   7. Electrical: Division 16

C. General Design:
   1. Contract Drawings and Specifications: The Contract Drawings and Specifications shall be considered as complementary so that materials and work indicated, called for, or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. The Contract Drawings are to be considered diagrammatic, not necessarily showing in detail or to scale all of the equipment or minor items. In the event of discrepancies between the Contract Drawings and Specifications, or between either of these and any regulations or ordinances governing work of these specifications, the bidder shall notify the Engineer in ample time to permit revisions.

1.02 QUALITY ASSURANCE

A. Materials and Equipment: Unless otherwise specified, all materials and equipment furnished for permanent installation in the work shall conform to applicable standards and specifications and shall be new, unused, and undamaged when installed or otherwise incorporated in the work. No such material or equipment shall be used by the Contractor for any purpose other than that intended or specified, unless such use is specifically

authorized in writing by the Owner. No material shall be delivered to the work site workout prior acceptance of drawings and data by the Engineer.

B. Where applicable, manufacturers shall be selected from the Orange County Utilities "List of Materials and Approved Manufacturers" (see Appendix) or approved equal.

C. Equivalent Materials and Equipment:
   1. When a material or article is specified or described by name of a proprietary product or of a particular manufacturer or vendor, the mentioned item shall be understood as establishing the type, function, and quality desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the products proposed are equivalent to those named. Such items shall be submitted for review in accordance with Section 01300: Submittals.
   2. Requests for review of equivalency will not be accepted only from the Contractor and such requests will not be considered until after the contract has been awarded.

D. Governing Standards: Equipment and appurtenances shall be designed in conformity with ANSI, ASME, ASTM, IEEE, NEMA, OSHA, AGMA, and other generally accepted applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses that may occur during fabrication, testing, transportation, installation, and all conditions or operations. All bearings and moving parts shall be adequately protected against wear by bushings or other acceptable means. Provisions shall be made for adequate lubrication with readily accessible means.

E. Tolerances: Machinery parts shall conform to the dimensions indicated on the drawings within allowable tolerances. Protruding members such as joints, corners, and gear covers shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

F. Clearances: Ample clearances shall be provided for inspection and adjustment. All equipment shall fit the allotted space and shall leave reasonable access room for servicing and repairs. Greater space and room required by substituted equipment shall be provided by the Contractor and at his or her expense.

G. Testing:
   1. When the equipment is specified to be factory tested, the results of the tests shall be submitted to the Engineer and approval of the test results shall be obtained before shipment of the equipment.
   2. When an item of equipment, including controls and instrumentation, has been completely erected, the Contractor shall notify the Engineer, who will designate a time to make such tests as required, and operate the item to the satisfaction of the Contractor. All testing shall be done in the presence of the Contractor. "Completely erected" shall mean that the installation is erected, all necessary adjustments have been made, all required utility connections have been made, required lubricants and hydraulic fluid have been added and the unit has been cleaned and painted.

H. Pressure Test:

1. After installation, all piping shall be pressure tested. Piping shall be tested in accordance with Section 15044.
2. All tests shall be made in the presence of and to the satisfaction of the Construction Manager and also to the satisfaction of any local or state inspector having jurisdiction.
    a. Provide not less than three days notice to the Construction Manager and the authority having jurisdiction when it is proposed to make the tests.
    b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Construction Manager shall be retested in part or in whole as directed by the Construction Manager.
    c. The piping systems may be tested in sections as the work progresses by no joint or portion of the system shall be left untested.
3. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.
4. All defects and leaks observed during the tests shall be corrected and made tight in an approved manner and the tests repeated until the system is proven tight.
5. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.
6. Provide test pumps, gauges, or other instruments and equipment required for the performance of all tests. Provide all temporary bracing, test plugs, additional restraint, and thrust blocking which may be required for test pressures above normal working pressures.
7. All tests shall be maintained for as long a time as required to detect all defects and leaks but not less than the duration specified for each type of pipe or piping system in this Division.

I. Failure of Test:
1. Defects: Any defects in the equipment, or deviations from the guarantees or requirements of the Specifications, shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to correct any defects or deviations, or if the replaced equipment when tested shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his or her having made partial payment for work and materials which have entered into the manufacturer for such equipment, may reject that equipment and order the Contractor to remove it from the premises at the Contractor's expense.
2. Rejection of Equipment: In case the Owner rejects a particular item of equipment, then the Contractor hereby agrees to repay to the Owner all sums of money paid to him to deliver to the Contractor a bill of sale of all his or her rights, title, and interest in and to the rejected equipment provided, however that the equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected. The bill of sale shall not abrogate the Owner's right to recover damages for delays, losses or other conditions arising out of the basic Contract. The Owner hereby agrees to obtain the alternate equipment within a reasonable time and the Contractor agrees that the Owner may use the original equipment furnished by him or her without rental or other charge until the other equipment is obtained.

J. Responsibility during Tests: The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

K. Acceptance of Materials:
   1. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and acceptance of the Owner. No material shall be delivered to the work without prior submittal approval of the Engineer.
   2. The Contractor shall submit to the Engineer data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.
   3. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit samples of materials for such special test as may be necessary to demonstrate that they conform to the specification. Such sample shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for tests.
   4. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporation in the work.

L. Safety Requirements:
   1. In addition to the components shown and specified, all machinery and equipment shall be safeguarded in accordance with the safety features required by the current codes and regulations of ANSI, OSHA, and local industrial codes.
   2. The Contractor shall provide for each V-belt drive or rotating shaft a protective guard which shall be securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements.
   3. For double inlet fans, the belt guard shall be arranged so as not to restrict the air flow into the fan inlet. Guards shall not interfere with lubrication of equipment.

1.03 SUBMITTALS (SEE SECTION 01300: SUBMITTALS)

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packaging: All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.

B. Protection: All machined surfaces and shafting shall be cleaned and protected from corrosion by the proper type and amount of coating necessary to assure protection during

shipment and prior to installation. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage as specified in Sections 09900 and 09905. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

C. Lubrication: Grease and lubricating oil shall be applied to all bearings and similar items as necessary to prevent damage during shipment and storage.

D. Marking: Each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

E. Fabricated subassemblies, if any, shall be shipped in convenient sections as permitted by carrier regulations and shall be properly match-marked for ease of field erection.

F. Responsibility:
   1. The Contractor shall be responsible for all material, equipment, and supplies sold and delivered to the site under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.
   2. 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 Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

G. Delivery: Contractor shall arrange deliveries of products in accordance with construction schedules and coordinate to avoid conflict with work and condition at the site.
   1. Contractor shall deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
   2. Immediately on delivery, Contractor shall inspect shipments to assure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged.
   3. Under no circumstances shall Contractor deliver equipment to the site more than one month prior to installation without written authorization from the Construction Manager. Operation and maintenance data shall be submitted to the Engineer for review prior to shipment of equipment as described in Section 01730: Operating and Maintenance Data.

H. Storage and Protection of Products:
   1. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this project. Equipment storage shall be in strict accordance

with the "Instructions for Storage" of each equipment supplier and manufacturer including connection of space heaters and placing of storage lubricants in equipment. Corroded, damaged, or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.

a. Contractor shall store products subject to damage by the elements in weather-tight enclosures.
b. Contractor shall maintain temperature and humidity within the ranges required by manufacturer's instructions.
c. Contractor shall store fabricated products aboveground, on blocking or skids, to prevent soiling or staining. Contractor shall cover products that are subject to deterioration with impervious sheet coverings and provide adequate ventilation to avoid condensation.
d. Contractor shall store loose granular materials in a well drained area on solid surfaces to prevent mixing with foreign matter.

2. All materials and equipment to be incorporated in the work shall 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.
3. Cement, sand, and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural and miscellaneous steel and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt, or grease, and in a position to prevent accumulations of standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and peeling to a minimum.
4. All materials that, in the Construction Manager’s opinion, have become damaged and are unfit for the intended or specified use shall be promptly removed from the site and Contractor shall receive no compensation for the damaged material or its removal.
5. Contractor shall arrange storage in a manner to provide easy access for inspection. Contractor shall make periodic inspections of stored products to assure products are maintained under specified conditions and free from damage or deterioration.
6. Protection after Installation: Contractor shall provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Contractor shall remove covering when no longer needed.

I. Extended Storage Requirements for Equipment: Because of the long period allowed for construction, special attention shall be given to extended storage and handling of equipment onsite. As a minimum, the procedure specified herein shall be followed:
   1. If equipment will be stored onsite for more than one month prior to incorporation into the Work, the Contractor shall submit a written request to the Construction Manager outlining any special provision to be made to protect and maintain the equipment while it is being stored. All such provisions shall be acceptable to the Construction Manager. No equipment shall be stored onsite for more than one month without prior written authorization from the Construction Manager.

2. All equipment having moving parts, including gears, electric motors, and/or instruments, shall be stored in a temperature- and humidity-controlled building accepted by the Construction Manager until such time as the equipment installation.
3. All equipment shall be stored fully lubricated with oil and grease unless otherwise instructed by the manufacturer.
4. Manufacturer's storage instructions shall be carefully studied by Contractor and reviewed by Contractor with the Construction Manager. These instructions shall be carefully followed and a written record of this review kept by the Contractor.
5. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". Upon equipment installation, the Contractor shall start the equipment, and operate loaded when possible, weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
6. Lubricants shall be changed upon installation completion and as often as required thereafter during the period between installation and acceptance. if stored for longer than ninety days, mechanical equipment to be used in the work shall have the bearings cleaned, flushed, and lubricated prior to testing and startup, at no extra cost to the Owner.
7. Prior to acceptance of the equipment, the Contractor shall 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 shall 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 guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective, and it shall be removed and replaced at Contractor's expense.
8. A maintenance log shall be maintained by the Contractor outlining the schedule of maintenance required for each piece of equipment, the date on which the maintenance was actually performed, and the initials of the individual performing the work. Submit a copy of the maintenance log monthly with the progress pay application.
9. All motors for storage shall have motor space heater active and wired from nearest power source to prevent moisture entering the motor.

1.05 WARRANTY AND GUARANTEES

A. The manufacturer's written warranty shall be submitted for all major pieces of equipment, as specified in Section 01740: Warranties and Bonds. The manufacturer's warranty period shall be concurrent with the Contractor's correction period for one year after the time of completion and acceptance.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials that come into contact with the water being treated or the finished water shall be on either the EPA or NSF lists of products approved for use in contact with potable water. Manufacturers shall submit an affidavit with the shop drawings indicating

approval by the EPA or NSF for the materials used in products that come into contact with the water, in accordance with Rule 62555.320(3) Florida Administrative Code.

2.02 MATERIALS AND EQUIPMENT

A. Fabrication and Manufacture:
   1. Workmanship and Materials:
      a. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.
      b. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.
      c. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least ¼-inch thick.
   2. Lubrication:
      a. Equipment shall be adequately lubricated by systems that require attention no more than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.
      b. Lubricants of the type recommended by the equipment manufacturer shall be furnished by the Contractor in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner. Unless otherwise specified or permitted, the use of synthetic lubricants will not be acceptable.
      c. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.
   3. Safety Guards: All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated form 16 USS gage or heavier galvanized or aluminum-clad sheet steel or ½-inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard and shall be galvanized, including bolts. All outdoor safety guards shall be designed to prevent the entrance of rain and dripping water.
   4. Equipment Foundation Supports:
      a. All foundations, platforms and hangers required for the proper installation of equipment shall be furnished and installed by Contractor.
      b. Unless otherwise indicated or specified, all equipment shall be installed on reinforced concrete bases at least 6 inches high and shall conform to Section

03300. Cast-iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in Section 03600: Grout. All open equipment bases shall be filled with non-shrinking grout sloped to drain to the perimeter of the base.

c. The Contractor shall furnish, install, and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances required for the installation of equipment. These shall be of ample size and strength for the purpose intended.
d. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolts shall comply with Section 05500: Miscellaneous Metals and, unless otherwise specified, shall have a minimum diameter of ¾-inch. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1½ inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.
e. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping furnished under this Division shall be provided and installed by Contractor.
f. All foundations, anchor pads, piers, thrust blocks, inertia blocks and structural steel supports shall be built to template and reinforced as required for loads imposed on them.
g. Contractor shall assume all responsibility for sizes, locations, and design of all foundations, anchor pads, pier, thrust blocks, inertia blocks, curbs and structural steel supports.

5. Shop Painting:
   a. All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with high-grade, oil-resistant enamel suitable for coating in the field with an alkyd enamel. Coatings shall be suitable for the environment where the equipment is installed.
   b. Surfaces to be painted after installation shall be prepared as recommended by the paint manufacturer for the intended service and then shop painted with one or more coats of the specified primer. Unless otherwise specified, the shop primer for steel and iron surfaces shall be Cook "391-N-167 Barrier Coat", Koppers "No. 10 Inhibitive Primer", or equal.
   c. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound, Houghton "Rust Veto 344", Rust-Oleum "R-9", or equal.

6. Nameplates: Contractor shall provide equipment identification nameplates for each item of equipment. Nameplates shall be 1/8-inch Type 304 stainless steel and shall be permanently fastened using round head metallic drive screws, or, where metallic drive screws are impractical, with stainless steel pop rivets. Metallic drive screws shall be brass or stainless steel, Type V and No. 8 by 3/8-inch long. Names and/or equipment designations shall be engraved on the plates and the engraving painted with a primer and black paint system compatible with stainless steel. Contractor shall submit a list of proposed names and designations for review prior to fabrication of nameplates. At a minimum, each nameplate shall include equipment manufacturer's name, year of manufacture, serial number, and principal rating data.
7. Pipe Identification:
    a. All pipe (except underground) shall have code letters and flow arrows painted as per specification Section 09905. The contractor shall ensure that the pipes are properly marked.
    b. Underground pipe and tube: Pipe and tube shall be located by laying 2-inch wide plastic tape continuously along the run of pipe or tube. Where possible, color of tape shall be consistent with the color of bands on interior pipe and as approved by the Engineer, or shall bear an imprinted identification of the line.
        1) Location: Tape shall be laid approximately 12 inches below ground surface and directly over pipe location.
        2) Manufacturer: Tape shall be as specified in Section 09905.
8. Valve Identification: On all valves except shut-off valves located at a fixture or piece of equipment, the Contractor shall provide a coded and numbered tag attached with brass chain and/or brass "S" hooks.
    a. Tag Types:
        1) Tags for valves on pipe and tube lines conducting hot medium (steam, condensate, hot water, etc.) shall be brass or anodized aluminum.
        2) Tags for all other valves shall be Type 304 stainless steel.
        3) Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.
    b. Coding: In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the line service. All color and letter coding shall be approved by the Engineer.
    c. Valve Schedule: The Contractor shall provide a typewritten list of all tagged valves giving tag shape, letter code and number, the valve size, type, use, and general location within building.
9. Fire Hazard Rating:
    a. All piping, duct work, and equipment insulation, fastener, and jacketing materials shall have a fire hazard rating not to exceed 25 for flame spread, 50 for fuel contributed, and 50 for smoke developed. Rating shall be determined by ASTM Designation E84, "Surface Burning Characteristics of Building Materials". Corresponding ratings determined by Underwriters' Laboratories, Inc., UL-723, "Test Method for Fire Hazard Classification of Building Materials", will also be acceptable.
    b. Flame-proofing treatments will not be acceptable.
10. Heating, Ventilation, and Domestic Plumbing Equipment:

a. Interchangeability: In all design and purchasing, interchangeability of items of equipment, subassemblies, parts, motors, starters, relays, and other items is essential. All similar items shall be of the same manufacturer, type, model, and dimensions.

2.03 ACCESSORIES

A. Special Tools and Accessories: Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

2.04 SPARE PARTS

A. Spare parts for certain equipment provided under Divisions 11, 13, 14, 15, and 16 have been specified in the pertinent sections of the specifications. The Contractor shall collect and store all spare parts in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing of all spare part, the equipment with which they are associated, and the name and address of the supplier.

B. Maintenance Materials:
   1. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.
   2. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of operation.

2.05 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for project.

PART 3 – EXECUTION

3.01 PREPARATION (NOT APPLICABLE)

3.02 INSTALLATION

A. Installation: Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of Contractor or Contractor’s subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.
   1. The Contractor shall have sufficient proper construction equipment and machinery of ample capacity onsite to facilitate the work and to handle all emergencies normally

encountered in work of this character. To minimize field erection problems, mechanical units shall be factory assembled when practical.

2. Equipment shall be erected in a neat and skilled manner on the foundations and supports at the locations and elevations shown on the Drawings, unless otherwise directed by the Engineer during installation.
3. All equipment shall be installed in such a manner as to provide access for routine maintenance including lubrication.
4. For equipment such as pumping units, which require field alignment and connections, the Contractor shall provide the services of the equipment manufacturer's qualified mechanic, millwright, machinist, or authorized representative, to align the pump and motor prior to making piping connections or anchoring the pump base.
5. Equipment of a portable nature that require no installation shall be delivered to a location designated by the Owner.

B. Tolerances: Precision gauges and levels shall be used in setting all equipment. All piping and equipment shall be perfectly aligned, horizontally and vertically. Tolerances for piping and equipment installation shall be ½-inch to 30-foot horizontal and vertically. All valves and operators shall be installed in the position shown on the Contract Drawings or as directed by the Engineer, if not shown.

C. Alignment and Level: The equipment shall be brought to proper level by shims (¼-inch maximum). After the machine has been leveled and aligned, the nuts on the anchor bolts shall be tightened to bind the machine firmly into place against the wedges or shims. Grouting shall be as specified in Section 03600: Grout.

D. Grouting: The grout shall be tamped into position with a board, steel bar, or other tool. Tamping should not be so hard as to raise or otherwise displace the plate.

E. Contact of Dissimilar Metals: Where the contact of dissimilar metal may cause electrolysis and where aluminum will contact concrete, mortar, or plaster, the contact surface of the metals shall be separated using not less than one coat of zinc chromate primer and one heavy coat of aluminum pigmented asphalt paint on each surface.

F. Cutting and Patching: All cutting and patching necessary for the work shall be performed by the Contractor.

G. Operation: All equipment installed under this Contract, including that furnished by Owner or others under separate contract, shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.

3.03 INSPECTION AND TESTING

A. Where the specifications require observation of performance tests by the County Professional or RPR, such tests shall comply with the quality assurance paragraph in this section.

3.04 START-UP AND INSTRUCTION

A. Services Furnished Under This Contract:
   1. An experienced, competent, and authorized representative of the manufacturer of each item of equipment shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation. The manufacturer's representative shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Construction Manager.
   2. Owner and Construction Manager shall be furnished a letter of certification by each manufacturer's representative that states the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been operated under full load conditions and that it operated satisfactorily.
   3. All costs for field services shall be included in the contract amount.

END OF SECTION

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SECTION 15044

PRESSURE TESTING OF PIPING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section specifies the leakage testing requirements for plant piping.

B. Related Work Described Elsewhere:
   1. Section 11241: Chemical Feed System.
   2. Section 15070: Schedule 80 Polyvinyl Chloride (PVC) Pipe, Fittings and Valves.
   3. Section 15100: Ancillary Equipment.

C. General Design (not applicable)

1.02 QUALITY ASSURANCE

A. Test Pressures: Test pressures for the various services and types of piping shall be as shown in Table 15044-A, and, at a minimum, shall be 1.5 times the working pressure.

1.03 SUBMITTALS

A. Materials and Shop Drawings (Not Applicable)

B. Additional Information:
   1. Testing Plan: Submit prior to testing and include at least the information that follows:
      a. Testing dates.
      b. Piping systems and section(s) to be tested.
      c. Test type.
      d. Method of isolation.
      e. Calculation of maximum allowable leakage for piping section(s) to be tested.
   2. Certifications of Calibration: Testing equipment.
   3. Certified Test Report.
   4. Testing Records:
      a. Provide a record of each piping installation during the testing. These records shall include:
         1) Date of test.
         2) Identification of pipeline tested or retested.
         3) Identification of pipeline material.
         4) Identification of pipe specification.
         5) Test fluid.
         6) Test pressure.
         7) Remarks: Leaks identified (type and location), types of repairs, or corrections made.

8) Certification by Contractor that the leakage rate measured conformed to the specifications.
9) Signature of Owner's representative witnessing pipe test.

b. Submit five (5) copies of the test records to the Engineer's representative upon completion of the testing.

PART 2 – PRODUCTS

2.01 GENERAL

A. Testing fluid shall be clean water for all piping except air service and shall be of such quality to prevent corrosion of materials in piping system for all hydrostatic tests. Air piping shall be tested using compressed air.

2.02 MATERIALS AND EQUIPMENT

A. Provide pressure gauges, necessary bracing and restraint, test plugs, pipes, bulkheads, pumps, and meters to perform the hydrostatic and pneumatic testing.

PART 3 – EXECUTION

3.01 PREPARATION

A. Pipes shall be in place and anchored before commencing pressure testing.

B. Conduct hydrostatic and pneumatic tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.

C. Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. For pneumatic tests, blow air through the pipes.

D. Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, special flanges, or blind flanges. After the new line has been successfully tested, remove caps or flanges and connect to the existing piping.

E. Conduct hydrostatic tests on buried pipe after the trench has been completely backfilled. The pipe may be partially backfilled and the joints left exposed for inspection for an initial leakage test. Perform the final test, however, after completely backfilling and compacting the trench.

F. Chlorine Piping: Test, dry, and clean in accordance with requirements of Chlorine Institute Pamphlet 6.

G. New Piping Connected to Existing Piping: Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Engineer.

H. Items that do not require testing include: Piping between wet wells and wet well isolation valves, equipment seal drains, tank overflows to atmospheric vented drains, and tank atmospheric vents.

I. Gravity Piping:
   1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
   2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to Engineer.

J. Pressure Test:
   1. All tests shall be made in the presence of and to the satisfaction of the Owner or Engineer and also to the satisfaction of any local or state inspector having jurisdiction.
      a. Provide not less than three (3) days notice to the Owner, Engineer, and the authority having jurisdiction when it is proposed to make the tests.
      b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Engineer shall be retested in part or in whole as directed by the Engineer.
      c. The piping systems may be tested in sections as the work progresses, but no joint or portion of the system shall be left untested.
   2. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.
   3. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.

3.02 INSTALLATION (NOT APPLICABLE)

3.03 INSPECTION AND TESTING

A. Hydrostatic Testing of Aboveground or Exposed Piping: The maximum filling velocity shall be 0.25 feet per second, applied over full area of pipe. Open vents at high points of the piping system to purge air while the pipe is being filled. Subject the piping system to the test pressure indicated. Maintain the test pressure for a minimum of four (4) hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show no leakage or weeping. Correct leaks and retest until no leakage is obtained.

B. Hydrostatic Testing of Buried Piping:
   1. Test after backfilling has been completed. Expel air from piping system during filling.
   2. Where any section of the piping contains concrete thrust blocks or encasement, do not make the pressure test until at least 10 days after the concrete has been poured. When testing mortar-lined piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.
   3. Apply and maintain the test pressure by means of a hydraulic force pump. Maintain the test pressure for a minimum duration of four (4) hours. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure

during the four hours. This amount of water is the loss due to leakage in the piping system. The allowable leakage rate is defined by the formula:

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

in which:

L = allowable leakage (gallons/hour) during the test period.
S = length of pipe, in feet
D = nominal diameter of the pipe (inches)
P = average test pressure during leakage test (psig)

4. Repair and retest any pipes showing leakage rates greater than that allowed.

C. Pneumatic Test For Pressure Piping:
   1. Do not perform on PVC or CPVC pipe.
   2. Fluid: Oil-free, dry air.
   3. Procedure:
      a. Apply preliminary pneumatic test pressure of 25 psig maximum to piping system prior to final leak testing, to locate visible leaks. Apply soap bubble mixture to joints and connections, examine for leakage.
      b. Correct visible leaks and repeat preliminary test until visible leaks are corrected.
      c. Gradually increase pressure in system to half of specified test pressure. Thereafter, increase pressure in steps of approximately one-tenth of specified test pressure until required test pressure is reached.
      d. Maintain pneumatic test pressure continuously for minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.
      e. Correct visible leakage and retest as specified.
   4. Allowable Leakage: Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.
   5. After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to assure no explosive mixtures will be present in system during filling process.

D. Hydrostatic Test For Gravity Piping:
   1. Testing Equipment Accuracy: Plus or minus ½-gallon of water leakage under specified conditions.
   2. Maximum Allowable Leakage: 0.16 gallon per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.
   3. Gravity Sanitary and Roof Drain Piping: Test with 15 feet of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 15 feet in height, test systems in 15-foot vertical sections as piping is installed.
   4. Exfiltration Test:
      a. Hydrostatic Head:
         1) At least 6 feet above maximum estimated groundwater level in section being tested.

2) No less than 6 feet above inside top of highest section of pipe in test section, including service connections.

5. Infiltration Test:
   a. Groundwater Level: At least 6 feet above inside top of highest section of pipe in test section, including service connections.
6. Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if pipe previously passed a pressure test.
7. Defective Piping Sections: Replace or test and seal individual joints, and retest as specified.

E. Test Pressure:
   1. All pipe shall be tested at pressures shown in Table 15044-A and at a minimum shall be 1.5 times the normal working pressure of the pipe.

3.04 START-UP AND INSTRUCTION (NOT APPLICABLE)

TABLE 15044-A

Service	Legend	Maximum Operation Pressure (psig)	Test Pressure (psig)
Drain	DR	Gravity	15 ft. WCH
Hydrofluorosilicic Acid	F	50	100
Sample Line	SA	70	150
Sodium Hypochlorite	C	50	100
Water Main	WM	70	150

Legend: WCH = Water Column Height

END OF SECTION

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SECTION 15061

STEEL PIPES AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. Furnish all labor, materials, equipment, and incidentals required and install, complete, ready for operation and field test all steel pipe as shown on the Drawings and specified herein.
   2. Steel pipe shall include black steel and galvanized steel pipe and fittings.
   3. Provide steel pipe only where specifically called out on the Drawings.

B. General Design: All of the pipe specified herein is intended to be standard steel pipe for use in transporting certain chemicals and finished water as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Qualifications: All steel pipe shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the steel pipe to be furnished. The equipment shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with all these specifications.

B. Standards: Steel pipe and fittings shall conform to all applicable standards of ASME, ANSI, and AWWA.

1.03 SUBMITTALS

A. Submit to the Engineer for approval, in accordance with the General Conditions and Division 1, shop drawings to include dimensioned drawings and technical specifications for all piping to be furnished.

B. Submit AWS certification for welders for the specific types and classes of welds being performed.

PART 2 – MATERIALS

2.01 STEEL PIPE AND FITTINGS

A. Standard Steel Pipe:
   1. Classes and maximum working pressures shall be as specified in ANSI B36.1 and as shown on the Drawings. Minimum wall thickness shall be as per Schedule 40 "Standard".
   2. ASTM A-120 carbon steel, lapwelded, or ASTM A-53 Carbon steel, seamless.

3. Zinc coated (galvanized) or black steel as indicated. No galvanized steel shall be used with the fuel system.
4. Underground: Coated with extruded polyethylene corrosion proof coating system where shown on the drawings or specified.
5. End Connections: As shown on the Drawings.

B. Fittings:
1. General Service Screwed: Standard pattern malleable iron with full-length clean-cut threads, ANSI B16.3.
2. Special Service Screwed: Class 2,000 or 3,000 forged steel.
3. Drainage Screwed: Cast iron recessed thread.
4. Welded:
   a. ASTM A-234 made from ASTM A-106 Grade B seamless tube.
   b. Long-radius elbows.
   c. Reducing tees for one size reduction, weld-o-lets, or thread-o-lets for small take-offs.
   d. 150-pound series-weld neck flanges ANSI B-16.5 using carbon steel, ASTM A-181, Grade 1.
5. Unions: 250 pound series malleable iron with brass to iron seats.
6. Grooved Joint Pipe Fittings:
   a. Manufacturer:
      1) Victaulic, Style 75
      2) Or equal
   b. Fittings as specified above, with pre-cut grooves.
   c. Gaskets: Manufacturers standard, or as required for intended service with respect to fluid, temperature and pressure.

2.02 STAINLESS STEEL PIPE AND FITTINGS

A. All stainless steel pipe and fittings shall be fabricated from Type 316L extra low carbon grade austenitic stainless steel sheet with a working pressure of 150 psi and maximum temperature of 250º Fahrenheit.
1. Pipe shall conform to ASTM A-312 and be die-formed or rolled true to dimension and round within a tolerance of plus or minus 1/6-inch.
2. The two edges of sheet shall be brought to line so as not to leave a shoulder on the inside of the pipe. Fittings shall conform to ASTM A-403.
3. Ends of pipe and fittings shall be true and perpendicular to the longitudinal axis with the edges deburred.
4. Pipes shall be straight within maximum of 1/8-inch deviation over 10 feet.
5. Longitudinal seams on pipe and fittings shall be welded by either the tungsten gas plasma, flux covered or the metallic-gas method. Welding rod or wire shall be of same composition or superior to the pipe and fittings material.
6. Weld deposit at the seams shall have a slight crown on both sides of the weld and no cracks or crevices shall be allowed. Excessive weld deposits, slag, weld spatter, and projections into interior of pipe shall be removed by grinding. The interior welds shall be smooth, even and shall not have an internal bead higher than 1/16-inch.
7. All pieces shall be marked with gauge and type of stainless steel.

8. Pipe and fittings shall be immersed in pickling solution in manufacturer's plant and scrubbed and washed until discoloration and possible iron, picked up from manufacturing process, is removed.

B. All stainless steel piping 2-inches and smaller shall be Schedule 80 for gas service and schedule 40 for water service. Piping 2½-inches and larger shall be Schedule 10 for general use and schedule 40 for high pressure gas.

C. Fittings:
   1. Fittings three inches and smaller shall be threaded conforming to ASTM A-182 forged, Class WP, same material and wall thickness as the pipe, conforming to ANSI B16.11.
   2. Fittings for buried or submerged pipe larger than three inches shall be butt-welded, conforming to ASTM A 403, Class WP, same material and wall thickness as the pipe, conforming to ANSI B16.9. Elbows shall be long radius.
   3. Fittings for aboveground or exposed pipe larger than three inches shall be butt-welded except when flanged or coupled, as shown on the drawings, conforming to ASTM A 403, Class WP, same material and wall thickness as the pipe, conforming to ANSI B16.9. Elbows shall be long radius.
   4. Branches:
      a. Outlets of size three inches and smaller in piping 4 inches and larger shall be of the Thredolet type, per AWWA Manual M11 (1964 edition), Figure 19.24. Outlets shall be 3,000 pound WOG stainless steel per ASTM A 182, or ASTM A 403. Threads shall comply with ANSI B2.01. Outlets shall be Bonny Forge Co. "Thredolet", Allied Piping Products Co. "Brachlet", or equal.
      b. For outlets three inches and smaller in piping smaller than four inches, use a threaded tee in accordance with c.i. above.
      c. For outlets larger than three inches, use a tee conforming to ASTM A 403, Class WP, with a flanged outlet or as shown on the Drawings.

D. Joints:
   1. Joints for pipes three inches and smaller shall be threaded or socket welded, same material as the pipe, 3,000 pound WOG, conforming to ANSI B16.11.
   2. Joints for buried or submerged pipe larger than three inches shall be butt-welded.
   3. Joints for above-ground or exposed pipe larger than three inches shall be butt-welded except where flanges or grooved end joints are shown on the Drawings.

E. Flanges:
   1. Provide weld-neck flanges conforming to ANSI B16.5 for piping three inches and smaller to connect to flanged valves, fittings, or equipment. Provide slip-on flanges for piping larger than three inches. Flanges shall be Class 150 per ANSI B16.5 unless specified otherwise. Flanges shall be Class 300 for the reverse osmosis feed water piping. Material for weld-neck and slip-on flanges shall conform to ASTM A 182, Grade F316. Flanges shall match the connecting flanges on the adjacent fitting, valve, or piece of equipment.
   2. Determine the pressure class of the flanges based on the test pressure specified in Section 15044.

3. Where a raised face steel flange connects to a flat face flange, remove the raised face on the steel flange.

F. Field welding will be allowed when approved by the Engineer. All field welding shall be performed by a AWS Certified welder and shall be tested for verification of weld.

G. Pipe ends shall be prepared for either mechanical or flexible couplings where shown on the Drawings.

H. Dead Ends of pipe runs shall have butt-welded ASME Code dished heads designed to meet the test pressures for the various pipes.

I. Bolts and Nuts for Flanges:
   1. Bolts and nuts for flanges shall be Type 316 stainless steel conforming to ASTM A 913, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
   2. Provide washer for each nut. Washers shall be of the same material as the nuts.

J. Gaskets for Flanges:
   1. Provide full-face gaskets for flat faced flanges. Provide ring gaskets for raised face flanges. Gaskets shall be composed of asbestos with rubber binder, 1/8-inch thick, Johns-Manville No. 60, John Crane Co. "Granite", or equal for high temperature air service and shall be constructed of rubber for ambient temperature water service.

K. Stainless Steel Ball Valves:
   1. Stainless steel ball valves shall be standard port type for the sizes indicated on the Drawings. Ball valves shall be designed for a working pressure of 200 psi with positive shut off when in the closed position. Valve body and ends shall be constructed of forged Type 316 stainless steel and valve ends shall be NPT threaded connections. The ball shall have a full bore port design machined from a solid metal piece with highly polished surfaces. The ball and stem shall be manufactured from Type 316 stainless steel. Manually operated ball valves shall be furnished with level operators manufactured of forged Type 316 stainless steel with a molded vinyl sleeve. Stainless steel ball valves shall be Type 1000 Neles-Jamesbury screwed end ball valves, or an equal approved by the Engineer."

PART 3 – EXECUTION

3.01 INSTALLATION

A. Threaded Joints:
   1. Ream the ends of threaded pipe to remove all burrs.
   2. Cut threads clean with long tapers.
   3. Remove all dirt and chips from the inside of the pipe and fittings and from the threads.
   4. Make up joints with an approved pipe joint compound or tape applied to the male threads only.

5. When connecting pipes to recessed drainage fittings, seat them against the shoulder of the fittings.
6. When required to back off joints, entirely disjoint, wipe the threads of both the pipe and fittings clean, apply new joint compound, and reassemble the connection.

B. Welded Connections:
1. All welding shall conform to ANSI B31.1.
2. All welders shall be certified for types and classes of welds being performed.
3. All welds shall be inspected for quality and suitability. Repair or replace all unsatisfactory welds.

C. Flanged Joints:
1. Tighten flange bolts so that the gaskets are uniformly compressed and sealed.
2. Do not distort flanges.
3. Leave flange bolts with the ends projecting 1/8-inch to 3/8-inch beyond the faces of the nuts after tightening.
4. Gasket material shall be compatible with pipeline fluid, temperature and pressure.

D. Grooved Joints:
1. Follow manufacturer's instructions.
2. Utilize manufacturer approved pipe grooving machines.
3. Lubricate all gaskets.
4. Torque all bolts as required by manufacturer.

E. Cutting: Cut pipe from measurements taken at the site; not from the Drawings.

F. To permit convenient disassembly for alterations and repairs, install unions or flanges where shown on the Drawings, and:
1. In long runs of piping, (greater than 20 ft.).
2. In bypasses around equipment.
3. In connections to traps, tanks pumps and other equipment.
4. Between shutoff valves.
5. In other locations as directed by the Engineer, and as indicated on the Drawings.

G. Hydrostatic Testing: Test in accordance with Section 15044.

3.02 PAINTING

A. All piping and fittings, under clamps and brackets exposed to view except stainless steel pipe shall be painted as specified in Division 9. Pipe marking is included in Division 9.

B. All buried black steel and galvanized steel piping shall receive an exterior coating consisting of two (2) coats of Coal Tar Epoxy applied at a rate to provide a minimum dry film thickness of 8 mils per coat.

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SECTION 15070

SCHEDULE 80 POLYVINYL CHLORIDE (PVC) PIPE, FITTINGS, AND VALVES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. Furnish all labor, materials, equipment, and incidentals required and install and test, in the locations as shown on the Drawings, the Schedule 80 polyvinyl chloride piping, fittings, and appurtenances specified herein. Schedule 80 PVC piping shall be used on all small diameter PVC piping systems (3 inches and smaller in diameter) that include, but are not limited to, non-potable water, potable water, and chemical feeds and in all other locations as shown on the Drawings.

B. Related Work Described Elsewhere:
   1. Painting: Section 09900.
   2. Piping, Valve and Equipment Identification System: Section 09905.
   3. Chemical Feed Systems: Section 11241.
   4. Mechanical – General Requirements: Section 15000.
   5. Pressure Testing of Piping: Section 15044.
   6. Ancillary Equipment: Section 15100.
   7. Pipe Hangers and Supports: Section 15126.

C. General Design:
   1. Schedule 80 PVC piping shall be installed in the locations as shown on the Drawings. All plastic pipe and fittings shall conform to this specification section whether provided as a part of an equipment "package" or purchased separately by the Contractor.
   2. All small diameter pipe 3-inch diameter and smaller shall be made of polyvinyl chloride unless specifically noted otherwise on the Drawings or in other sections of the specifications.

1.02 QUALITY ASSURANCE

A. All plastic pipe, fittings, and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items 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. The equipment shall be manufactured by Spears, IPEX, or an Engineer-approved equal.

B. All plastic valve of similar type shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The valve equipment shall be designed, constructed, and installed in accordance with the best

practices and methods and shall comply with these specifications. The equipment shall be manufactured by Asahi/America, Plast-O-Matic, Hayward, or approved equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings:
   1. Shop drawings shall be submitted to the Engineer for approval in accordance with the General Conditions and Section 01300. All products within this specification shall be combined into a single submittal that shall include at least the following:
      a. Dimensioning and the technical specification for all piping, fittings, and appurtenances to be furnished.
      b. Letter of Certification from the National Sanitation Foundation International (NSF) stating compliance with Standard 14 and Standard 61.
      c. Letter from the Manufacturer verifying chemical compatibility of all products to be used in chemical feed systems.
      d. For valves, show valve dimensions, including laying lengths. Show part sizes, show dimensions, and orientation of valve activators installed on the valves.
      e. For valves, submit Manufacturer's catalog data and detail construction sheets showing all valve parts. Describe each part by material of construction, specification (such as ANSI, ASTM, SAE, or CDA), and grade or type. Identify each valve by tag number and service to which the catalog data and detail sheets pertain.

B. Additional Information:
   1. Submit to the Engineer for approval samples of all materials specified herein, along with the manufacturer's Certificates of Inspection, descriptive literature, illustrations, specifications, installation instructions, and related information.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Piping, fittings, valves, and appurtenances shall be handled, shipped, and stored in accordance with Section 01610: Delivery, Storage, and Handling.

B. PVC pipe shall be delivered to the site in unbroken bundles packaged in such manner as to provide protection against damage. When possible, pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a forklift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.

C. When it is necessary to store PVC pipe for more than 30 days, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. PVC pipe shall not be stored close to heat sources or hot objects such as heaters, fires, boilers. or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil, and grease. The interior and all sealing surfaces of pipe, fittings, and other appurtenances shall be kept clean and free of dirt and foreign matter.

D. Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging, or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged or defective pipe and fittings, or any length of pipe having a gouge, scratch, or other permanent indentation of more than 10 percent of the wall thickness in depth, shall be rejected and removed at once from the work and replaced with new acceptable pipe at no additional cost to the Owner.

1.05 WARRANTY AND GUARANTEES

A. Provide equipment warranty in accordance with Section 01740: Warranties and Bonds.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials that come into contact with the water being treated or the finished water shall be on either the EPA or NSF lists of products approved for use in contact with potable water. Manufacturers shall submit an affidavit with the shop drawings indicating approval by the EPA or NSF for the materials used in products that come into contact with the water, in accordance with Rule 62555.320(3) Florida Administrative Code.

B. Valve shall include operator, actuator, operating nut, and accessories for a complete operation.

C. 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.

2.02 MATERIALS AND EQUIPMENT

A. PVC Pipe:
   1. Pipe shall be made of polyvinyl chloride, Schedule 80 pipe, conforming to ASTM D1785. Schedule 80 pipe shall have solvent welded or threaded joints. Chemical feed lines shall have solvent welded joints.

B. Fittings:
   1. Fittings for Schedule 80 pipe 4 inches and smaller in diameter shall be socket type, solvent welded in conformance with ASTM D 2467 or threaded type in conformance with ASTM D 2464. Solvent welded and threaded joints shall be watertight. Liquid chlorine feed lines shall have solvent welded fittings.
   2. Fittings for Schedule 80 pipe greater than 4 inches in diameter shall be socket type, solvent welded in conformance with ASTM D 2467. Fittings shall be a 1-piece injection molded design. Use of low pressure fabricated PVC fittings will not be permitted.

C. Solvent Cement:

1. PVC solvent cement in services other than Sodium Hypochlorite shall be in compliance with ASTM D 2564 and F656. Solvent Cement in Sodium Hypochlorite service shall be free of Silica. Products for Solvent Cement in Sodium Hypochlorite service shall be IPS "Weld-On" or Oatey "Lo V.O.C. PVC Heavy Duty Gray."
2. Solvent cement shall be specified by compatibility based on pipe service and size.
3. Manufacturer to provide certification with submittal.

D. Flanges:
   1. Slip-on flanges shall be provided to connect to flanged valves, fittings, or equipment. Flanges shall match the connecting flanges on the adjacent fitting, valve or piece of equipment and must meet the test pressure of the piping system as specified in Section 15044.
   2. Flange hardware (bolts, nuts, and washers) for PVC flanges shall be Type 316 stainless steel in accordance with ASTM F593 and F594, respectively. Flange hardware for PVC flanges on Hydrofluorosilicic Acid and Sodium Hypochlorite piping shall be Hastelloy C.
   3. Flange gaskets shall be EPDM for water service. For chemical feed piping systems, the gasket material shall be selected by the gasket manufacturer based on the chemical concentrations as specified in Section 15090: Chemical Feed System Piping.

E. Ball Valve:
   1. PVC Ball Valve:
      a. Valve: Ball valves shall be manufactured of Grade 1, Type I, PVC with Teflon seats. Seals shall be EPDM except for hydrofluorosilicic acid service that shall be Viton. Valve shall be provided with double unions and ball blocking feature.
      b. Operator: Handle.
      c. Pressure: 150 psi @ 73°F.
      d. Service: Water, hydrofluorosilicic acid.
      e. Plast-O-Matic True Blue, Asahi/America Type 21 Ball Valve, or approved equal.
   2. PVC Ball Valve with Vent Hole:
      a. Valve: Ball valve shall be manufactured of Grade 1, Type I, PVC and shall be of true union design with two-way blocking capability. The ball valve shall be suitable for sodium hypochlorite service. All O-rings shall be Viton and Teflon seats. Teflon seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double o-rings and be of blowout proof design. The addition of a 1/8-inch vent hole drilled and deburred by the manufacturer is required. The valve shall be installed with the vent hole on the upstream side of the system to keep the cavity of the ball fluidized. The valve handle shall double as carrier removal and/or tightening tool.
      b. Operator: Handle.
      c. Pressure: 150 psi @ 73°F.
      d. Service: 9-15% Sodium Hypochlorite.
      e. Plast-O-Matic True Blue, Asahi/America DuoBloc-21, or approved equal.

F. Check Valves:
   1. PVC Diaphragm Check Valve:

a. Valve: Diaphragm check valve shall be manufactured of Type I, Grade 1 PVC with a Viton diaphragm and shall be provided. The check valve shall utilize a normally closed design which is entirely automatic in action. The check valve must operate effectively in any position it is installed in.
b. Pressure: 150 psi @ 73°F.
c. Service: Water, hydrofluorosilicic acid, and sodium hypochlorite.
d. Plast-O-Matic Series CKM or approved equal.

2. PVC Ball Check Valve:
a. Valve: Ball check valve shall be manufactured of Type I, Grade 1 PVC with Viton seals and designed for horizontal or vertical installation with equal effectiveness. Valves shall be provided with double true unions.
b. Pressure: 150 psi @ 73°F.
c. Service: Water, hydrofluorosilicic acid and sodium hypochlorite.
d. Asahi/America, Hayward True Check, or approved equal.

G. Pressure Reducing Valves:
1. Valves shall be of the spring-loaded, direct-operated type for water service. The valves shall automatically convert high, varying inlet pressure to a lower, constant outlet pressure. Provide a valve design consisting of a spring in a chamber, acting on a diaphragm that transmits motion to the valve. Outlet pressure shall be adjustable through use of a screw driver. Body shall be PVC.
2. Outlet pressure shall be field adjustable over a range of 5 to 100 psi. Valves shall be Plast-o-Matic PHRM serices or approved equal.

H. Needle Valves:
1. Needle valves shall have a globe body of PVC (ASTM D1784) construction with screwed ends, screwed bonnet, and rising stem. Stem shall be PVC with Teflon seal. Needle valves shall be rated for 150 psi at 73 degrees F. Valves shall be Hayward or Engineer-approved equal.

I. Solenoid Valves:
1. Solenoid valves shall be designed for not less than 150 psi water working pressure and shall be installed where shown. Electrical operators for solenoid valves shall be in accordance with electrical drawings. Valves shall be two-way pattern, screwed, brass-body type, ASCO No. 8210 through 8223.

2.03 ACCESSORIES (NOT APPLICABLE)

2.04 SPARE PARTS

A. All special tools, solvents, lubricants, and cements required for normal installation shall be furnished with the pipe.

2.05 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for project.

PART 3 – EXECUTION

3.01 PREPARATION (NOT APPLICABLE)

3.02 INSTALLATION

A. Install PVC pipe and valves where shown on the Drawings and in strict accordance with the manufacturer's technical data and printed instructions.

B. Joints for Schedule 80 PVC pipe and fittings shall be solvent welded, flanged, or threaded. All joints shall be made watertight. All pipe cutting, threading, and jointing procedures for solvent welded and threaded PVC pipe joints shall be in strict accordance with the pipe and fittings manufacturer's printed installation instructions. Thread lubricant for threaded joints shall be Teflon tape only. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth if necessary, and apply solvent cement of proper grade.

C. Installation of valves and fittings shall be strictly in accordance with the manufacturer's instructions. Particular care shall be taken not to over-stress threaded connections at sleeves. In making solvent weld connections, the solvent shall not be spilled on valves or allowed to run from joints.

D. All piping shall have sufficient number of unions to allow convenient removal and shall be as approved by the Engineer.

E. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify their locations from approved piping layout Drawings and the structural Drawings.

F. Field Painting:
   1. Pipe normally exposed to view, under clamps and brackets shall be painted and marked as specified in Section 09905: Piping, Valve, and Equipment Identification System.

3.03 INSPECTION AND TESTING

A. All PVC piping shall be hydrostatically pressure tested and flushed in accordance with the requirements in Section 15044: Pressure Testing of Piping.

3.04 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 Engineer.

B. Standard: AWWA C651-92, "Standard 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 C651-92 and the appropriate FDEP permit. If necessary, the Contractor will be required to re-chlorinate.
   5. Sampling and analysis shall be done by the Owner.

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 Letter of Clearance is obtained from the Department of Environmental Protection.

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 and Reclaimed 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 and Reclaimed 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. For Wastewater Service
1. General: Wastewater force 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 change is 2-feet or greater, located in an enclosure as detailed on the Drawings.
2. Wastewater Combination Air Release Valves: The valve body shall be conical in shape and shall be 316 stainless steel with a funnel shape lower body to automatically drain sewage back into the system. All internal parts shall be corrosion resistant 316 stainless steel or non-metallic plastic materials.
3. On flanged connections 316 stainless steel bolts, nuts and washers are to be used along with the proper sized gasket.

C. Air release valves shall be installed 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

A. Polyethylene Service Pipe: One-inch and 2-inch service lines shall be polyethylene tubing conforming to AWWA C901 and AWWA C800. Tubing shall be approved for potable water use and bear the seal of the National Sanitation Foundation (NSF). The product shall be rated for a minimum working pressure of 150-psi and a (Dimension Ratio) DR-9 size. The tubing shall be designated copper tube size and the material PE-2406 cell classification minimum PE213323C in accordance with ASTM 3350.

B. Ductile Iron Service Pipe: Services 4-inch and larger shall be DIP. If the existing main is on the same side of the street as the property to be serviced, the service pipe shall be DIP from the point of connection to the existing main to the meter assembly. If the existing main is on the opposite side of the street as the property to be serviced, at a minimum, the segment of pipe immediately upstream from the meter assembly shall be DIP.

C. No service pipe shall terminate under a driveway.

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, joint restraints, 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.

D. Seal the flange gasket connections.

END OF SECTION

SECTION 15126

PIPE HANGERS AND SUPPORTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section covers the furnishing and installation of pipe hangers, brackets, and supports. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories.

B. General: Pipe supports, anchors, and expansion joints have been indicated on the Drawings in certain locations, but no attempt has been made to indicate every pipe support, hanger and anchors. It shall be Contractor's responsibility to provide a complete system of supports and to anchor all piping, in accordance with the requirements specified herein. Additional pipe supports may be required adjacent to expansion joints, couplings, or valves. When supports are shown on the Drawings, Contractor shall not relocate supports without Engineer’s approval.

1.02 QUALITY ASSURANCE

A. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for pipe supports shall be five times the ultimate tensile strength of the material, assuming 10 feet of water filled pipe being supported.

B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification stating compliance with such requirements.

C. Piping support system components shall comply with specified piping code requirements.

1.03 SUBMITTALS

A. Materials and Shop Drawings:
   1. Submit to the Engineer for approval, as provided in the General Conditions and Section 01300, shop drawings of all items to be furnished under this Section.
   2. Complete data and catalog cuts or drawings covering fabricated pipe supports, fabricated inserts, and stainless steel, supports shall be submitted in accordance with the Submittals section. Data shall include a listing of the intended use and general location of each item submitted.
   3. Submit to the Engineer, for approval, samples of all materials specified herein.

1.04 PRODUCT DELIVERY STORAGE AND HANDLING

A. The equipment provided under this section shall be shipped, handled, and stored in accordance with the Manufacturer's written instructions and in accordance with Section 01610: Delivery, Storage, and Handling.

PART 2 – PRODUCTS

2.01 GENERAL

A. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and cure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. All pipe supports shall be approved prior to installation.

B. Contractor shall select and design all piping support systems within the specified spans and component requirements. Structural design and selection of support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of 5.

C. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of the responsibility for providing them throughout the plant.

D. All support anchoring devices, including anchor bolts, inserts, and other devices used to anchor the support onto a concrete base, roof, wall, or structural steel works, shall be of the proper size, strength, and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.

E. All materials used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.

F. Hangers and supports shall be spaced in accordance with ANSI B31.1.0 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified herein.

G. Unless otherwise specified herein, metallic pipe hangers and supports shall be as manufactured by Anvil International, Inc., Carpenter and Patterson, Inc., or approved equal. Any reference to a specific figure number of a specific manufacturer is to establish a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design, and performance will be considered for approval.

H. Unless otherwise specified herein, non-metallic pipe hangers and supports shall be Aickinstrut or approved equal. Any reference to a specific figure number of a specific manufacturer is to establish a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design, and performance will be considered for approval.

2.02 MATERIALS AND EQUIPMENT

A. Pipe Hangers and Supports for Metal Pipe:
   1. Suspended single pipes shall be supported by hangers suspended by steel rods from galvanized concrete inserts, beam clamps, or ceiling mounting bolts as follows:
      a. Hangers:

Pipe Size, Inches	Anvil Fig. No.
Less than ½	138R
½ through 1	97C
1¼ through 4	104
6 through 12	590
14 through 30	171

      b. Hanger rods shall be rolled steel machine threaded with load ratings conforming to ASTM Specifications and the strength of the rod shall be based on root diameter. Hanger rods shall have the following minimum diameters:

Pipe Size, Inches Min.	Rod Diameter, In.
Less than 2½	3/8
2½ to 3	½
4	5/8
6	¾
8 to 12	7/8
14 to 18	1

      c. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes ½-inch through ¾-inch shall be equal to Anvil Fig. No. 229, and for rod sizes 7/8-inch through 1¼-inch shall be equal to Anvil Fig. No. 228, or equal.
      d. Concrete inserts for pipe hangers shall be; continuous metal inserts designed to be used in ceilings, walls or floors, spot inserts for individual pipe hangers, or ceiling mounting bolts for individual pipe hangers and shall be as manufactured by Unistrut Corp., Wayne, Michigan; Carpenter and Patterson, Inc., Laconia, New Hampshire; Richmond or equal and shall be as follows:
         1) Continuous concrete inserts shall be used where applicable and/or as shown on the Drawings and shall be used for hanger rod sizes up to and including 3/4-inch diameter. Inserts to be used where supports are parallel to the main slab reinforcement shall be Series P3200 by Unistrut Corp., Fig 1480 Type 2 by Carpenter and Patterson, Inc., or equal. Inserts to be used where supports are perpendicular to the main slab reinforcement shall be Series P3300 by Unistrut Corp., Fig. 1480 Type I by Carpenter and Patterson, Inc. or equal.

2) Spot concrete inserts shall be used where applicable and shall be used for hanger sizes up to and including 7/8-inch diameter. Inserts shall be Fig. 650 by Carpenter and Patterson, Inc. for hanger rod sizes ½-inch through and including ¾-inch, and Fig. 266 by Carpenter and Patterson Inc., for 7/8-inch hanger rods.
3) Ceiling mounting bolts shall be used where applicable and be for hanger rod sizes l-inch through and including 1¼-inch and shall be Fig. 104M as manufactured by Carpenter and Patterson, Inc., or equal.

e. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall be equal to Anvil Fig. No. 230.

2. Wall or column supported pipes shall be supported by welded steel brackets equal to Anvil Fig. 194, 195 and 199 as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.
   a. Where the pipe is located above the bracket, the pipe shall be supported by an anchor chair and U-bolt assembly supported by the bracket for pipes 4 inches and larger and by a U-bolt for pipes smaller than 4 inches. Anchor chairs shall be equal to Carpenter Patterson Fig. No. 127. U-bolts shall be equal to Anvil Fig. No. 120 and 137.
   b. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.
3. Floor-supported pipes 3-inches and larger in diameter shall be supported by either cast-in-place concrete supports or adjustable pipe saddle supports as directed by the Engineer. In general, concrete supports shall be used when lateral displacement of the pipes is probable (unless lateral support is provided), and adjustable pipe saddle type supports shall be used where later displacement of pipes is not probable.
   a. Each concrete support shall conform to the details shown on the Drawings. Concrete shall be poured after the pipe is in place with temporary supports. Concrete piers shall conform accurately to the bottom 1/3 to ½ of the pipe. Top edges and vertical corners of each concrete support shall have l-inch bevels. Each pipe shall be secured on each concrete support by a wrought iron or steel anchor strap anchored to the concrete with cast-in-place bolts or with expansion bolts. Where directed by the Engineer, vertical reinforcement bars shall be grouted into drilled holes in the concrete floor to prevent overturning or lateral displacement of the concrete support. Unless otherwise approved by the Engineer, maximum support height shall be five (5) feet.
   b. Concrete piers used to support base elbows and tees shall be similar to that specified above. Piers may be square or rectangular.
   c. Each adjustable pipe saddle support shall be screwed or welded to the corresponding size 150 pound companion flanges or slip-on welding flanges respectively. Supporting pipe shall be of Schedule 40 steel pipe construction. Each flange shall be secured to the concrete floor by a minimum of two (2) expansion bolts per flange. Adjustable saddle supports shall be equal to Anvil Fig. No. 264. Where used under base fittings, a suitable flange shall be substituted for the saddle.
4. Vertical piping shall be supported as follows:

a. Where pipes change from horizontal to vertical, the pipes shall be supported on the horizontal runs within 2 feet of the change in direction by pipe supports as previously specified herein.
b. For vertical runs exceeding 15 feet, pipes shall be supported by approved pipe collars, clamps, brackets, or wall rests at all points required to insure a rigid installation.
c. Where vertical piping passes through a steel floor sleeve, the pipe shall be supported by a friction type pipe clamp which is supported by the pipe sleeve. Pipe clamps shall be equal to Anvil Fig. 262.

5. Anchor bolts shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, Minnesota, or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, Colorado.
6. All rods, hangers, inserts, brackets, and components shall be furnished with galvanized finish.

B. Pipe Hangers and Supports for Plastic Pipe:
1. Single plastic pipes shall be supported by pipe supports as previously specified herein.
2. Multiple, suspended, horizontal plastic pipe runs, where possible, and rubber hose shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy, the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of mild steel construction. Rung spacing shall be approximately 18 inches for plastic pipe and 12 inches for rubber hose. Tray width shall be approximately 6-inch for single runs of rubber hose and 12 inches for double runs of rubber hose. Ladder-type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc. required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model M-CAC, Husky-Burndy Model SCR or approved equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe.
3. Individual clamps, hangers, and supports in contact with plastic pipe shall provide firm support, but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

C. Pipe Supports for Small Diameter PVC and Steel Pipe:
1. Small diameter Schedule 80 PVC piping 3-inch in diameter and smaller and steel piping 2-inch in diameter and smaller shall be supported with "SUSPORT" system arrangements as manufactured by Universal Suspension Systems Inc. of Gillette, NJ or an Engineer-approved equal. Clamping halves for the pipe support shall be manufactured of molded polypropylene and shall support and fit closely for 360° around the pipe. To support piping carrying non-corrosive fluids or gases and located in noncorrosive, indoor environments, all hardware for the "SUSPORT" system shall be nickel chrome plated carbon steel. To support piping carrying corrosive fluids or gases, piping located in corrosive environments, or piping located outdoors, all hardware for the system shall be manufactured of Type 316 stainless steel.
2. To adequately support small diameter PVC or steel piping, a metal frame support structure may be required to support the above-specified "SUSPORT" system. Where

required, metal frame support structures shall be constructed using channels, fittings, brackets, hardware, and other accessories as manufactured by B-Line Systems, Inc. of Highland, IL, or an Engineer- approved equal. Materials for the frame structure in indoor, non-corrosive environments shall be carbon steel with an epoxy coating applied by a cathodic electro-deposition process equal to "Dura-a-Green" by B-Line Systems, Inc. Materials for the frame structure in corrosive or outdoor environments shall be Type 316 stainless steel unless otherwise noted on the Drawings. Hardware used to construct the frame support structure shall be cadmium-plated for carbon steel supports or Type 316 stainless steel for stainless steel supports.

3. Pipe supports for small diameter PVC and steel piling shall be located wherever necessary to adequately support the pipe in the Engineer's opinion. They shall have a maximum spacing as specified below for straight pipe runs. Adequate supports shall especially be used adjacent to valves and fittings in pipelines. The following table is based on spacing requirements for Schedule 80 PVC or Standard Weight (Schedule 40) steel pipe carrying a fluid with a Specific Gravity of 1.0 at a temperature not exceeding 120°F. Support spacing for PVC or steel piping carrying fluids exceeding the above-stated Specific Gravities or temperatures shall be Engineer-approved.

Nominal Pipe Diameter, Inches	Support Spacing, Feet PVC Pipe	Steel Pipe
½"	3.5	4.5
¾"	4.0	5.0
1"	4.5	5.5
1¼"	5.0	6.5
1½"	5.0	7.5
2"	5.5	8.0
2½"	5.5	-
3"	6.0	-

2.03 ACCESSORIES (NOT APPLICABLE)

2.04 SPARE PARTS (NOT APPLICABLE)

2.05 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for this project.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to prime coating, all pipe hangers and supports shall be thoroughly clean, dry and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.

B. All submerged pipe supports shall be prime coated with Koppers 654 Epoxy Primer or approved equal. All other pipe supports shall be prime coated with Rustinhibitive Primer No. 621 as manufactured by Koppers Company, Inc., Pittsburgh, Pa., or equal.

C. Finish coating shall be compatible with the prime coating used and shall be applied as specified in Section 09900: Painting.

3.02 INSTALLATION

A. All pipes, horizontal and vertical, shall be rigidly supported from the building structure by approved supports. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless it is so indicated on the Drawings, or specifically directed or authorized by the Engineer.

B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.

C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

D. Pipe supports shall be provided as follows:
   1. Cast iron and ductile iron shall be supported at a maximum support spacing of 10 feet, 0-inch with minimum of one support per pipe section at the joints.
   2. All vertical pipes shall be supported at each floor or at intervals of at least 15 feet by approved pipe collars, clamps brackets or wall rests, and at all points necessary to insure rigid construction.

E. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.

F. Inserts for pipe hangers and supports shall be installed on forms before concrete is poured. Before setting these items, all Drawings and figures shall be checked that have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

G. Continuous metal inserts shall be embedded flush with the concrete surface.

H. Standard Pipe Supports:
   1. Horizontal Suspended Piping:
      a. Single Pipes: Adjustable swivel-ring, splint-ring, or clevis hangers.
      b. Grouped Pipes: Trapeze hanger systems.

c. Furnish galvanized steel protection shield and oversized hangers for all insulated pipe.
d. Furnish precut sections of rigid insulation with vapor barrier at hangers for all insulated pipe.

2. Horizontal Piping Supported From Walls:
   a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall mounted framing also acceptable.
   b. Stacked Piping:
      1) Wall mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
      2) Piping clamps which resist axial movement of pipe through support not acceptable.
   c. Wall mounted piping clips not acceptable for insulated piping.
3. Horizontal Piping Supported From Floors:
   a. Stanchion Type:
      1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.
      2) Use yoke saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.
      3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
   b. Floor Mounted Channel Supports:
      1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.
      2) Attach channel framing to floors with anchor bolts.
      3) Attach pipe to channel with clips or pipe clamps.
   c. Concrete Cradles: Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.
4. Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.
5. Standard Attachments:
   a. To Concrete Ceilings: Concrete inserts.
   b. To Steel Beams: I-beam clamp or welded attachments.
   c. To Wooden Beams: Lag screws and angle clips to members not less than 2½-inch thick.
   d. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
6. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.

3.03 INSPECTION AND TESTING (NOT APPLICABLE)

3.04 START-UP AND INSTRUCTION (NOT APPLICABLE)

END OF SECTION

SECTION 15300
FIRE PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Basic Requirements: Provisions of Section 15050, BASIC MECHANICAL REQUIREMENTS, are a part of this Section.

1.02 SUMMARY

A. General: Provide the fire protection systems indicated on the drawings and within this specification section.

1.03 SUBMITTALS

A. General: Include the following data:

B. Manufacturers Literature:
   1. Dimensional outline drawing and verification of UL/FM approval for the following list of equipment:
      a. Each different type of valve.
      b. Each different type of piping hanger, supports, and sleeves.
      c. Each type of fire sprinklers.
      d. Fire department connection.
      e. Waterflow devices and supervisory switches.
      f. Piping and fittings.
      g. Firestopping.
      h. Inspectors test and drain.

C. Installation Instructions:
   1. Manufacturer's printed instructions for the installation of sprinkler system items including copies shipped with the equipment.

D. Maintenance Instructions:
   1. Test procedures and frequency of testing required for each component per manufacturer’s recommendations.
   2. Instructions to the Owner's designated employees on the operation of the entire system.

E. Piping Shop Drawings: Submit 1/4" scale piping shop drawings as prescribed in Section 15050 and as required by codes. Shop drawings shall include sprinkler piping cut lengths, offsets, fittings and devices, elevations, hangar locations, sprinkler head count by type, elevation sections and other installation information.

F. Submit hydraulic calculations proving the viability of the most hydraulically remote areas of the project. Indicate hydraulic reference points and submit computer analyzed nodal calculations in both tabular and graphical formats. Hydraulic imbalance shall not exceed 0.01 gpm at any node, and water velocity shall not exceed 20 feet per second. Demonstrate compliance with the requirements of NFPA-13 regarding density, area of application, selection of hydraulically remote areas, and maximum coverage per sprinkler.

G. Test Plan: Submit a "Test Plan" which describes how the system(s) will be tested, including a step-by-step procedure of all tests indicating type and location of test apparatus to be employed. The tests shall demonstrate that the operating and installation requirements have been met.

1.04 APPLICABLE STANDARDS

A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15050.

B. NFPA - Fire Sprinkler System: The fire sprinkler protection systems installation, flushing and testing shall comply with the requirements of NFPA 13, 24, and 25.

C. Pipe Thread Pattern: All threads shall be in accordance with local fire department specifications and NFPA.

D. UL/FM Approval: All equipment, valves, couplings, hangers and devices shall be approved by Underwriters' Laboratory (UL) and Factory Mutual (FM) for use in fire protection service.

E. Florida Building Code: Latest approved edition.

1.05 QUALITY ASSURANCE

A. Licensure: The fire protection systems shall be installed by a State of Florida Certified Fire Protection Contractor I.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. General: Refer to Section 15050.

B. Single Manufacturer: All items of a similar type shall be by the same manufacturer.

2.02 STANDARD SPRINKLERS

A. General: Fire sprinkler frames and bulbs shall be color-coded to identify the temperature rating of the fusible element. Unless otherwise indicated, fire sprinkler heads shall have 1/2 inch threaded male connection and 1/2 inch orifice, shall have an intermediate temperature rating and brass frame with flat brass finish.

B. Pendant: Pendant sprinklers shall be manufactured for installation below the branch line.
   1. Acceptable Manufacturers:
      a. Viking
      b. Tyco
      c. Reliable

C. Upright: Upright sprinklers shall be manufactured with upright deflectors for installation above the branch line.
   1. Acceptable Manufacturers:
      a. Viking
      b. Tyco
      c. Reliable

2.03 QUICK-RESPONSE SPRINKLER HEADS

A. General: Provide upright, horizontal sidewall, or pendant-type sprinkler heads with quick-response action, with integral chrome-plated escutcheon plate.

B. Pendent: Pendant sprinklers shall be manufactured for installation below the branch line.
   1. Acceptable Manufacturers:
      a. Viking
      b. Tyco
      c. Reliable

C. Upright: Upright sprinkler heads shall be manufactured with upright deflectors for installation above the branch line.
   1. Acceptable Manufacturers:
      a. Viking
      b. Tyco
      c. Reliable

D. Spare Fire Sprinkler Cabinet: Provide sufficient spare sprinklers cabinets to store the required quantities of sprinklers in accordance with NFPA 13. Storage cabinets shall be red gloss, polyester-coated steel construction. Provide a minimum of six spare sprinklers of each type and each different temperature rating installed; provide (2) two installation tools or wrenches with each different type of sprinkler head. Cabinet shall have catch-lock and continuous piano hinge. Locate the spare fire sprinkler cabinet as directed by Fire Department.

1. Acceptable Manufacturers:
    a. Viking
    b. Tyco
    c. Reliable

E. Sprinkler Cage Guard: Provide open-wire cage guard to protect sprinklers from damage. Cage wire shall be cadmium-plated steel.
    1. Acceptable Manufacturers:
        a. Viking
        b. Tyco
        c. Reliable

2.04 PIPE AND FITTINGS

A. General: Only the following materials designed for 175 psig CWP shall be used for fire protection piping unless specifically indicated otherwise. All piping materials shall have a corrosion resistance rating (CCR) of 1.0 or greater.

B. Pipe: 2 inch and smaller pipe, and all threaded or welded piping shall be black steel, Schedule 40, ASTM A-53. 2-1/2 inch and larger pipe shall be black steel with roll-grooved or welded joints, Schedule 40, ASTM A-135.

C. Fittings: 2 inch and smaller pipe shall be joined by mechanical couplings, threaded or welded fittings; 2-1/2" and larger pipe shall be joined by rolled groove couplings or welded fittings only. Welded branch connections which are at least 2 nominal pipe sizes smaller than the main are permitted. Threaded fittings are acceptable only for piping 2 inches and smaller.

D. Corrosion Protection: All black steel pipe and fittings exposed to the exterior, moisture or corrosive fumes shall have a protective coating, such as factory hot-dipped galvanization; galvanized painting of piping is prohibited.

E. Flanges: Flanged fittings shall be threaded or welded, cast iron or steel, short body, Class 125. Gaskets shall be full face 1/8 inch minimum thickness red sheet rubber. Flange bolts shall be hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B18.2. Grooved flanges shall not be permitted. Flange gaskets for dry pipe systems shall be made of material specifically listed for air service.

F. Underground Piping: Underground piping shall be Ductile Iron Class 52, UL/FM approved. Fittings shall be Class 250, Mechanical Joint. All underground pipe lengths and bends shall be rodded and all bends shall have thrust blocks.

2.05 VALVES

A. Gate Type Isolation, 2-1/2 Inch and Larger: Isolation valves 2-1/2 inch and larger shall be gate valves with open screw and yoke. Valve shall have cast iron body with the valve size, pressure rating, manufacturer, and "UL" and "FM" cast into the body. Valve shall have bronze or cast iron double disc and wedge, cast iron handwheel, bolted cast iron bonnet, non-re-lubricatable bronze stem with O-ring seals, and corrosion inhibiting asphalt varnish finish. Valve shall have 175 psig CWP working pressure, 350 psig test pressure, flanged connections, and shall be provided with an integral tamper switch.
   1. Acceptable Manufacturers:
      a. Stockham
      b. Mueller
      c. Crane
      d. Nibco

B. Butterfly Type Isolation, 2-1/2 Inch and Larger: Isolation valves 2-1/2 inch and larger shall be cast iron body butterfly valves with the valve size, pressure rating, manufacturer and "UL" and "FM" cast into the body. Valve shall have bronze or cast iron disc, neoprene disc liner, cast iron handwheel with disc position indicator, integral tamper switch, 175 psig CWP working pressure, 350 psig CWP test pressure, and flanged or grooved connections.
   1. Acceptable Manufacturers:
      a. Victaulic Series 708
      b. Grinnell 8000 FP
      c. Central ModelBFV

C. Check Valve: Check valves shall be horizontal swing type rated for 175 psig CWP working pressure and 350 psig test pressure. Check valves shall have cast iron body with the valve size, "UL", "FM" and flow directional arrow cast into the body; bronze disc ring with cast iron disc; bronze hinge and hinge plug; malleable iron clapper arm; and bolted cast iron cover. Provide factory painted or hot-dipped galvanized finish.
   1. Acceptable Manufacturers:
      a. Flanged Connection:
         1) Stockham
         2) Mueller
         3) Nibco
      b. Grooved Connection:
         1) Reliable
         2) Grinnell
         3) Central

D. Indicator Valve: Indicator valves shall be gate valve with non-rising bronze stem. Valve shall have cast iron body with the valve size, pressure rating, manufacturer, and "UL" and "FM" cast into the body. Valve shall have cast iron double disc and wedge, bronze seat ring, square cast iron operating nut compatible with the indicator socket, bolted cast iron bonnet, cast iron post indicator valve stuffing box with fiber gasket and rubber O-rings, cast iron

indicator post flange, and asphalt varnish finish. Valve shall have 175 psig CWP working pressure, 350 psig test pressure, and flanged connections.

1. Acceptable Manufacturers:
    a. Mueller
    b. Nibco
    c. Stockham

2.06 WATERFLOW DEVICES AND SUPERVISORY SWITCHES

A. Isolation Valve Tamper Switch: Provide an electronic supervisory or tamper switch on each isolation valve in the sprinkler system. Unit shall have a red tamper-proof cover which will activate an alarm or trouble signal when adjusted. Provide unit with single-pole, normally closed microswitch, mounting bracket, and non-resettable lock with removable reset key.
    1. Acceptable Manufacturers:
        a. Simplex
        b. Potter-Roemer
        c. Potter Electric Signal Co

B. Flow Switch: Provide an electric flow switch where indicated or required. Flow shall be sensed by an immersion paddle, with an adjustable retard setting from 0 to 70 seconds to minimize false alarms. Flow switch shall have 2 separate single pole, double throw microswitches to activate a flow alarm, or to indicate a trouble signal if the flow switch housing is tampered. Flow alarm shall be automatically resetting. Provide clamp-on housing to secure unit to pipe, or threaded connection for tee fitting.
    1. Acceptable Manufacturers:
        a. Potter-Roemer
        b. Potter Electric Signal Co
        c. System Sensor

C. Inspector's Test and Drain: Test and drain shall be provided with integral sight glass, integral 1/2 inch test orifice and positive positioning of handle for off, test and drain operations.
    1. Acceptable Manufacturers:
        a. G/J Innovations, Inc
        b. AGF Manufacturing, Inc
        c. Victaulic

D. Electric Alarm Bell: 10 inch electric bell 120 VAC.
   1. Acceptable Manufacturers:
      a. Notifier
      b. Potter-Roemer
      c. Potter Electric Signal Co

PART 3 - EXECUTION

3.01 INSTALLATION

A. Water Service Connection: Provide a double check valve backflow preventer in the fire service connection to the domestic water main. Refer to civil plans.

B. Hangers: Pipe hangers on 4 inch and larger piping shall be clevis-type only. All hanger spacing shall comply with the requirements of NFPA-13.

C. Flushing: The entire system shall be flushed with clean water to remove debris resulting from installation. Flush through a burlap bag to retain debris for examination.

D. Prohibited: Do not paint any fire sprinklers.

E. Exposed fire sprinkler piping shall be painted with metal primer and finish coat per Division 09.

3.02 EQUIPMENT INSTRUCTION PLATES

A. General: Provide engraved instruction plates detailing emergency procedures at each system control panel and at each hazard area manual discharge station locations. Permanent nameplates shall be used in the control panel to identify control logic units, contactors and major circuits.

3.03 HYDROSTATIC TESTS

A. General: Above ground and below ground piping systems shall be hydrostatically tested at not less than 200 psi pressure, or at 50 psi in excess of the maximum pressure, whichever is greater, for a period of 2 hours. The test pressure shall be read from a gauge located at the low elevation point of the individual system or portion of the system being tested. The sprinkler piping shall not have leakage exceeding the amounts specified in NFPA 24. Leakage quantities shall be determined by pumping at the specified test pressure from a calibrated container. Repair leaking joints and retest as necessary until all systems have been tested. Test the piping between the check valve in the fire department inlet pipe and the outside connection the same as the balance of the system.

B. Test Blank: Test blanks (blind flanges) used shall be the self-indicating type, with red painted lugs protruding beyond the flange to clearly indicate their presence. Number all test blanks to assure removal after the testing is completed.

3.04 SYSTEM INSPECTION AND CHECKOUT

A. General: After the installation is complete, the system shall be inspected by factory trained personnel in accordance with the manufacturer's recommended procedures.

B. System Operation: Operate systems as required to demonstrate that the systems are operating in accordance with the design, including line pressure testing. Supply instruments required to read data. Adjust systems to operate at the required performance levels. Advise Designer 7 days prior to testing. Tabulate data and submit on 8-1/2 x 11 inch sheets with time, name of tester and the local Authority Having Jurisdiction witnessing the test, with one copy for each Technical Information Brochure.

3.05 INSTRUCTIONS TO OWNER

B. General: Provide to Owner's designated representatives a minimum of 2 hours classroom and on-site instructions in operation and maintenance of all fire protection systems and equipment. Furnish 6 sets of typed operating instructions. Written and signed acknowledgement of the instructions seminar shall be submitted prior to final acceptance. Submit in writing to the Owner an "Instruction in Operation Conference" notification of the mutually agreed upon time for the conference. At the end of the conference, 6 copies of an Instruction in Operation Conference Memo shall be signed by all parties and one copy shall be inserted in each Technical Information Brochure.

END OF SECTION

SECTION 15800
VENTILATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work includes all labor, materials and equipment required to provide a complete, safe and workable air conditioning, heating and ventilation system as outlined in the Drawings and hereinafter specified. The following list is included as a guide to the Contractor, but work is not necessarily limited to these principal items briefly mentioned.

1.02 QUALIFICATIONS

A. Wherever manufacturer's model and/or catalog numbers are noted on the Drawings or in the Specifications, such numbers indicate the grade, type, quality, physical arrangement, size, performance characteristics and availability of parts and service necessary to perform the function of that item.

B. Substituted equipment will be approved only when the Contractor can demonstrate to the Architect's or Engineer's satisfaction that all of the above listed requirements can be met. Any architectural, structural, mechanical or electrical changes required to adapt substituted equipment to the Drawings and Specifications shall be included in this Contract.

C. Where additional manufacturers are listed in either the Specifications or Drawings, equipment shall be limited to items manufactured by those firms specifically named.

1.03 SUBMITTALS

A. Thoroughly coordinated shop drawings shall be submitted for approval in accordance with Section 01300: Submittals where specifically called for on the Drawings, or as specified herein.
   1. Submit shop drawings and complete performance data for all major pieces of equipment, showing dimensions arrangement, connection sizes, electrical wiring diagram, power requirements and clearances required for access of service. When equipment being submitted is a substitution, shop drawings shall include factory certification that the equipment has the required capacity, or shall include copies of manufacturer's published performance data. Any calculations that may be required to prove that the equipment will operate as required shall be submitted together with the factory data.

2. Equipment proposed of different manufacturer, size of arrangement than that shown will require complete shop drawings, which clearly show how the equipment fits the available space and in relation to adjacent equipment, with all connections shown such as piping, duct adjacent equipment, with all connections shown such as piping, duct, work, etc. Plan views shall be supplemented with two sections or more.
3. Provide submittal data for air distribution devices, installation materials and duct work.

B. All shop drawings submitted for approval shall be stamped by the Contractor before submission to indicate that the shop drawings are complete, checked and comply with all aspects of the requirements of all Contract Documents.

C. All shop drawings shall be submitted within 30 days from the date contract is awarded.

D. Shop drawing approvals by the Engineer will not relieve the Contractor from responsibility for his or her own errors, nor from his or her responsibility for full compliance with the Contract Documents.

E. All data and drawings shall be submitted simultaneously in an indexed booklet.

F. Coordination with work specified under other divisions:
1. Submit for approval complete power and control field wiring diagrams for all equipment supplied in this Section of the work.
2. Submit for approval a drawing indicating location and sizes of all roof penetrations, curbs and pitch pans required for this work.

G. Warranty for the equipment in accordance with Section 01740: Warranties and Bonds.

1.04 OPERATING AND MAINTENANCE MANUALS

A. When the installation is complete, submit to the Engineer, as required in Section 01730: Operation and Maintenance Data, copies of the following, bound in a hard cover booklet:
1. General operating instructions, including copies of posted specific instructions and automatic control diagrams.
2. Maintenance instructions, followed by tabulated manufacturer's descriptive literature, shop drawings, performance curves and rating data, spare parts lists and manufacturer's maintenance manuals.
3. Names, addresses and telephone numbers of local service representatives of the manufacturers of the installed equipment.

PART 2 – PRODUCTS

2.01 POWER ROOF AND WALL VENTILATIONS

A. The ventilation fans and relief vents shall be of the type and capacity indicated on the Drawings, and shall be furnished complete with all accessory items specified. Provide back draft dampers, bird screen and integral disconnect switches on all exhaust fans. Belt drives shall have adjustable pulleys.

B. Acceptable Manufacturer:
   1. Loren Cook Company, Springfield, Missouri.
   2. Greenheck Fan Corporation, Schofield, Wisconsin.

C. Requirements of Regulatory Agencies: Conform to the requirements of the State of Florida.

D. Source Quality Control: AMCA labeled (Air Moving and Conditioning Association).

E. Backdraft Dampers:
   1. Gravity Operated:
      a. Multiple blade.
      b. Interlocked and gasketed aluminum, blades.
      c. Nylon or other type rust proof bearings.
      d. Adjustable spring attached to tie rods or counter weights.
      e. Tie rod connecting each blade.
      f. Located at inlet to unit.
      g. Furnished by same manufacturer as power roof ventilator unit.

F. Curb Gasket: Sponge rubber gaskets cemented to inner edge of curb cap to provide air and water seal between curb and curb gap.

G. Ventilator to Curb Fasteners: Cadmium plated lag screws or bolts.

H. Prefabricated Curbs:
   1. Prefabrication: Aluminum or FRP, insulated where required.
   2. Curb Height: 10 inches.
   3. Curb Extension: 10 inches above roof deck.
   4. Fabricated with horizontal surface for mounting roof ventilator.

2.02 THERMOSTATS

A. Thermotats shall be line voltage coil bulb control:
   a. Contact Current Rating Resistive @ 120VAC 22 Amps,
   b. Contact Current Rating Resistive @ 240VAC 22 Amps, Inductive Rating @ 120 VAC 16 Amps,
   c. Inductive Rating @ 240 VAC 8 Amps, Sensor Hydraulic Cap,

d. Switch SPDT,
e. Temperature Differential 3 to 12 Degrees Fahrenheit,
f. Application Heating/Cooling Ventilation,
g. Control Range 30-110 Degrees F
h. Manufactured by Dayton Grainger item # 4LZ94

2.03 ACCESSIBILITY

A. All equipment requiring adjustment or service shall be fully accessible by means of location, clearance to structure, etc. All access panels shall be readily removed and replaced. All fire dampers shall be accessible for inspection or repair. Unless otherwise required or noted, all access doors shall be at least 12 inch x 12 inch milcor Style "A" for acoustical tile, Style "B" for acoustical plaster and Style "K" for plaster or stucco.

2.04 MATERIALS

A. All materials specified herein shall be new and of domestic manufacture.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of all equipment and materials shall be in strict accordance with the best practice of the several trades and with the respective manufacturer's instructions and recommendations.

B. Install all fans to prevent vibration and drumming and be certain that all fan bearings are properly greased before starting fans.

C. Install ventilator in accordance with manufacturer's instructions.

3.02 TESTING AND BALANCE

A. The Contractor shall obtain the services of an independent test and balance agency that specializes in and whose business is limited to testing and balancing of air conditioning systems. The agency selected shall be fully certified by the Associated Air Balance Council and shall have at least one member of the agency qualified as a certified test and balance engineer that has been issued this certification by the National Examining Board, United States and Canada. All final reports shall be signed by this certified test and balance engineer and shall include his or her official stamp.

B. Testing and balancing shall be performed in complete accordance with AABC National Standards for Field Measurement and Instrumentation, Form Number 81266, Volume One, section applicable to air distribution and section applicable to hydronic balancing.

C. Instruments used for testing and balancing of air and hydronic systems must have been calibrated within a period of six months and checked for accuracy prior to start of work.

D. The complete test report shall be submitted to the consulting mechanical engineer prior to final acceptance of the project.

E. Selected and approved agency shall submit AABC National Warranty certificate which includes pre-construction plan check and continuous inspection program immediately upon receipt of the test and balance contract.

F. The Contractor shall submit name of the test and balance agency to architect and consulting mechanical engineer for approval within 30 days after receipt of construction contract by air conditioning contractor.

END OF SECTION

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DIVISION 16
ELECTRICAL

SECTION 16100
ELECTRICAL WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Contractor shall provide all labor, materials, equipment and incidentals as shown, specified, and required to complete the Electrical Work.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the walls, partitions, ceilings and panels.

C. Intent:
   1. Drawings show the principal elements of the electrical installation. They are not intended as detailed working drawings for the electrical Work but as a complement to the Specifications to clarify the principal features of the electrical systems for bidding purposes only.
   2. Rough-in of conduits and equipment to be based upon approved shop drawings.
   3. It is the intent of this Section that all equipment and devices, furnished and installed under this and other Sections, be properly connected and interconnected with other equipment so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown.

D. Grounding: Ground all equipment in conformance with the National Electrical Code.

E. Temporary Power:
   1. CONTRACTOR shall provide temporary light and power for construction purposes to be utilized by all trades on the project.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Permits: Obtain all permits required to commence.
   2. Codes: Material and equipment shall be installed in accordance with the current standards and recommendations of the National Electrical Code, the National Electrical Safety Code and with local codes which apply. Where discrepancies arise between codes, the most restrictive regulation shall apply.
   3. Tests by Independent Regulatory Agencies: Electrical material and equipment shall be new and shall bear the label of the Underwriters' Laboratories, Inc., or other nationally-recognized, independent testing laboratory, wherever standards have been established and label service regularly applies.

B. Reference Standards: Electrical material and equipment shall conform in all respects to the latest approved standards of the following:
   1. National Electrical Manufacturers Association (NEMA).
   2. The American National Standards Institute (ANSI).
   3. The Institute of Electrical and Electronic Engineers (IEEE).
   4. Insulated Cable Engineers Association (ICEA).
   5. National Electrical Code (NEC).
   6. National Electrical Safety Code (NESC).
   7. National Fire Protection Association (NFPA).
   8. Instrumentation Society of America (ISA).
   9. Underwriters' Laboratories, Inc. (UL).

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's name and product designation or catalog number.
   2. Electrical ratings.
   3. Dimensioned plan, section, and elevations showing means for mounting, conduit connection, and grounding.
   4. Materials and finish specification, including paints.
   5. List of components including manufacturer's names and catalog numbers.
   6. Internal wiring diagrams indicating all connections to components and numbered terminals for external connections.

1.04 AREA CLASSIFICATIONS

A. Wet Locations: The following areas shall be considered wet locations:
   1. All outdoor areas.
   2. All indoor areas below grade unless otherwise specified.
   3. Indoor areas above grade where designated and shown.
   4. Materials, equipment and incidentals in areas identified as wet locations shall meet NEC and NEMA requirements for wet locations. Enclosures shall meet NEMA 4 requirements as a minimum and NEMA 4X requirements where specified. Conduits shall be terminated at enclosures with watertight, threaded hubs.

PART 2 - PRODUCTS

2.01 RACEWAY SYSTEMS

A. General:
   1. The types of raceways required include the following:
      a. Rigid aluminum conduit for exposed indoor conduit runs in non-corrosive areas.
      b. Schedule 40 PVC for underground conduit runs.
      f. Flexible conduit for connections to motors and equipment.
   2. Coordination:

a. Conduit runs shown are diagrammatic.
b. Coordinate conduit installation with piping, ductwork, lighting fixtures and other systems and equipment and locate so as to avoid interferences.

B. Conduit Fittings and Outlet Bodies:
1. Material and Construction: Malleable iron and covers. Outdoor units to be gasketed and watertight. Gaskets to be of an approved type designed for the purpose. Improvised gaskets not acceptable. All units to be threaded type with five full threads. Material to conform to be listed by UL. The use of "LB" fittings shall be avoided and type "LBD" fittings applied wherever the use of fittings is unavoidable. All hardware shall be stainless steel.
2. Manufacturer: Provide metallic conduit fittings and outlet bodies of one of the following:
a. Crouse-Hinds Company.
b. Appleton Electric Company.
c. Or equal.

C. PVC Conduit:
1. Material: Schedule 40 PVC plastic, NEMA Type EPC-40-PVC, 90 C rated, conforming to UL No. 651.
2. Fittings: Form elbows, bodies, terminations, expansions and fasteners of same material and manufacturer as base conduit. Provide cement by same manufacturer as base conduit.
3. Manufacturer: Provide PVC conduit of one of the following:
a. Amoco Chemicals Corporation.
b. Carlon, Division of Indian Head, Incorporated.
c. Or equal.

D. Conduit Hubs:
1. Material: Threaded conduit hub, vibration proof, weather proof with captive O-ring seal, aluminum with insulated throat.
2. Use: Provide for all conduit terminations to boxes, cabinets and other enclosures located in areas designated as wet locations.
3. Manufacturer: Provide material manufactured by Myers Electrical Products Company or equal.

H. Flexible Conduit:
1. Material: Flexible aluminum core with smooth, abrasion resistant, liquid-tight, polyvinyl chloride cover. Continuous copper ground built in for sizes ¾-inch through 1-1/4 inch. Material shall be UL listed.

I. Flexible Conduit Fittings:
1. Material and Construction: Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed.
2. Manufacturer: Provide flexible conduit fittings of one of the following:
a. Crouse Hinds Company.

b. Appleton Electric Company.
c. Or equal.

J. Pull and Junction Boxes:
1. Material and Construction:
a. 316 Stainless Steel boxes.
b. Neoprene gaskets. Gaskets to be of an approved type designed for the purpose. Improvised gaskets not acceptable.
c. 316 Stainless steel cover screws.
d. External mounting lugs.
e. Drilled and tapped conduit holes.
f. Boxes where conduits enter a building below grade shall have ¼-inch drain hole.
2. Manufacturer: Provide pull and junction boxes of one of the following:
a. Crouse Hinds Company.
b. Appleton Electric Company.
c. Or equal.

2.02 WIRE AND CABLE

A. 600 Volt Cable:
1. Insulated Cable In Raceways:
a. Material: Single conductor copper cable conforming to ASTM B3 and B8 with flame-retardant, moisture and heat resistant thermoplastic insulation rated 90 C in dry locations and 75 C in wet locations and listed by UL as XHHW.
b. Wire Sizes: Not smaller than No. 12 AWG for power and lighting and No.14 AWG for 120 volt control circuits.
c. Stranding: All 600 volt cable shall be stranded.
2. Cable Connectors, Solderless Type:
a. For wire sizes up to #6 AWG, use compression type.
b. For sizes #4 AWG and above, use either compression type or bolted type with silver-plated contact faces.
c. Properly size connectors to fit fastening device and wire size.

B. Instrumentation Cable:
1. Single Shielded Pair:
a. Tinned copper, stranded conductors, #18 AWG minimum, twisted with aluminum-polyester shield, stranded tinned 20 AWG copper drain wire and overall chrome vinyl jacket. Rated for 600 volts minimum.
2. Multipaired Shielded:
a. Tinned copper, 7 strand XLPE insulated conductors, #18 AWG minimum, twisted in pairs with aluminum-mylar shield over each pair, silicone rubber fiberglass fire barrier tape, tinned copper drain wire, aluminum mylar overall shield, Hypalon outer jacket.
3. Manufacturer: Provide shielded cable of one of the following:
1) Okonite Company.

2) Belden Company.
3) Dekoron Wire and Cable Company.
4) Or equal.

2.03 WIRING DEVICES

A. Outlet Boxes:
1. Material: Cast aluminum in damp, wet or exterior locations and zinc-coated sheet steel in climate controlled locations.
2. Device Cover Plates:
a. Stainless steel Type 316 alloy for indoor finished areas.
b. Gasketed spring door type for devices designated as weatherproof.
c. Integral with device for hazardous locations.
d. Stainless steel screws and hardware.
3. Manufacturer: Provide device boxes of one of the following:
a. Crouse-Hinds Company.
b. Appleton Electric Company.
c. Or equal.

B. Snap Switches:
1. Switches for Non-Hazardous Locations:
a. Single pole AC toggle switch, quiet type, 120/277 volt AC, 20 ampere, Ivory, specification grade.
1) Product and Manufacturer: Provide one of the following:
a) Cat. #1221-I, as manufactured by Harvey Hubbel Incorporated.
b) Cat. #1991-I, as manufactured by Arrow-Hart Incorporated.
c) Or equal.
2. Switches for Hazardous Locations:
a. Material: Factory sealed tumbler switch suitable for installation in Class I, Group D hazardous locations. Cast gray iron alloy or cast malleable iron body and cover with zinc electroplate finish. Switch rated at 20 amperes, 120/277 volt AC.
b. Product and Manufacturer: Provide one of the following:
1) Series EDS, as manufactured by Crouse Hinds Company.
2) Type EDS, as manufactured by Appleton Electric Company.
3) Or equal.

C. Receptacles:
1. Receptacles for Non-Hazardous Locations:
a. Duplex grounding receptacle, two pole, three wire, 125 volt AC, 20 ampere.
1) Product and Manufacturer: Provide one of the following:
a) Cat. #53CM62, as manufactured by Harvey Hubbell Incorporated.
b) Cat. #5362-CR, as manufactured by Arrow-Hart Incorporated.
c) Or equal.

2.04 GROUNDING SYSTEMS

A. Bare Ground Cable:
   1. Material: Annealed, bare, stranded tinned copper, No.8 AWG minimum size.
   2. Manufacturer: Provide ground cable of one of the following:
      a. Cablec Corporation.
      b. General Cable Corporation.
      c. Rome Cable Company.
      d. Or equal.

B. Ground Rods:
   1. Material: Copperclad rigid steel rods, 1/2-inch diameter, 20 feet long.
   2. Manufacturer: Provide ground rods by one of the following:
      a. Copperweld, Bimetallics Division.
      b. ITT Blackburn Company.
      c. Or equal.

C. Grounding Connectors:
   1. Material: Pressure connectors to be copper alloy castings, designed specifically for the items to be connected, and assembled with Durium or silicone bronze bolts, nuts and washers. Welded connections to be by exothermic process utilizing molds, cartridges and hardware designed specifically for the connection to be made.
   2. Manufacturer: Provide grounding connectors of one of the following:
      a. Pressure Connectors:
         1) O.Z./Gedney, Division of General Signal Corporation.
         2) Burndy Corporation.
         3) Or equal.
      b. Welded Connections:
         1) Cadweld by Erico Products, Incorporated.
         2) Therm-O-Weld by Burndy Corporation.
         3) Or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:
   1. Mount equipment so that sufficient access and working space is provided for safe operation and maintenance.
   2. Securely fasten enclosures to walls and other structural surfaces on which they are mounted. Provide independent supports where no walls or other structural surface exists.
   3. Install in conformance with the National Electrical Code.

B. Raceway Systems:
   1. Supports:
      a. Rigidly support conduits by clamps, hangers or unistrut channels.

b. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface. Support multiple runs of conduits on trapeze type hangers with stainless steel horizontal members and threaded hanger rods, Kindorff or equal. Rods shall be not less than 3/8-inch diameter, and shall be stainless steel.

2. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures by the following methods:
   a. To Wood: Wood screws.
   b. To Hollow Masonry Units: Toggle bolts.
   c. To Brick Masonry: Price expansion bolts, or equal.
   d. To Concrete: Phillips; Hilti Corporation; or equal, anchors.
   e. To Steel: Welded threaded studs, beam clamps or bolts with lockwashers or locknuts.
3. Exposed Conduit:
   a. Install parallel or perpendicular to structural members or walls.
   b. Wherever possible, run in groups. Provide stainless steel conduit racks of suitable width, length and height and arranged to suit field conditions. Support every ten feet minimum.
   c. Install on structural members in protected locations.
   d. Locate clear of interferences.
   e. Maintain 6 inches from hot fluid lines and 1/4-inch from walls.
   f. Install vertical runs plumb. Unsecured drop length not to exceed 12 feet.
4. Conduit Embedded in Concrete:
   a. Separation: Three times outer diameter of larger conduit center to center.
   b. Minimum Slab Thickness:
      1) With no crisscrossing of conduit, three times outer diameter of conduit.
      2) With crisscrossing of conduits, four times outer diameter of larger conduit.
   c. Run conduit in center of slab.
   d. Before concrete is placed, make the necessary location measurements of the conduit to be embedded so that the information is available to prepare record drawings.
5. Underground Conduits:
   a. Install individual underground conduits a minimum of 20 inches below grade unless otherwise indicated.
   b. Perform all excavation, bedding, backfilling and surface restoration including pavement replacement where required.
   c. Make conduit connections watertight.
   d. Protect metallic conduits from corrosion by the following means:
      1) Apply 2 coats of a bitumastic coating.
   e. All underground conduits are to be concrete encased with red dye.
6. Empty Conduits:
   a. Install nylon pull wire in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose.
   b. Identify each empty conduit with a durable tag showing the conduit number indicated on the Drawings.

7. Field Bends: No indentations. Diameter of conduit shall not vary more than 15 percent at any bend.
8. Joints:
    a. Apply conductive compound to all joints before assembly.
    b. Make up joints tight and ground thoroughly.
    c. Use standard tapered pipe threads for conduit and fittings.
    d. Cut conduit ends square and ream to prevent damage to wire and cable.
    e. Use full threaded couplings. Split couplings not permitted.
    f. Use strap wrenches and vises to install conduit. Replace conduit with wrench marks.
9. Terminations:
    a. Install insulated bushings on conduits entering boxes or cabinets, except threaded hub types.
    b. Provide locknuts on both inside and outside of enclosure for grounding.
    c. Bushings not to be used in lieu of locknuts.
10. Moisture Protection:
    a. Plug or cap conduit ends at time of installation to prevent entrance of moisture or foreign materials.
    b. Make underground and embedded conduit connections watertight.
    c. Thru wall Seals: Install for conduits passing through new exterior subsurface walls or base slabs of buildings and for conduits passing through existing exterior walls. For individual exposed conduits passing through interior walls, install non-metallic sleeves to protect the conduit against action of alkaline substances which may be present.
    d. Drainage: Pay particular attention to drainage for conduit runs. Wherever possible, install conduit runs so as to drain to one end and away from buildings. Avoid pockets or depressions in conduit runs.
11. Corrosion Protection:
    a. Conduit Curb:
        1) In concrete slabs or floors, provide a two inch high curb extending two inches from the outer surface of the conduit penetrating the floor, to prevent corrosion.
        2) Terminate conduit stub-ups in couplings, slightly above the finished concrete curb.
    b. Dissimilar Metals:
        1) Back paint aluminum in contact with masonry or concrete with two coats of aluminum-pigmented bituminous paint.
12. Flexible Conduit:
    a. Install at motors and equipment which are subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept ¾-inch size flexible conduit. Limit flexible conduit length to three feet maximum.
13. Pull and Junction Boxes:
    a. Install pull boxes in runs containing more than three 90 degree bends, runs exceeding 200 feet, where indicated on the Drawings and where required to conform to the National Electrical Code.

b. Size junction and pull boxes in accordance with the requirements of the National Electrical Code.
c. Provide terminal blocks in junction boxes where cable terminations.

17. Sealing Fittings: Install for hazardous and corrosive locations as required by the National Electrical Code and where shown on the Drawings.
18. Expansion/Deflection Fittings: Install fittings where conduits cross structural expansion joints.

C. Wire and Cables:
1. 600 Volt Cable:
a. Install all cables complete with proper terminations at both ends. Check and correct for proper phase sequence and proper motor rotation.
b. Pulling:
1) Use insulating types of pulling compounds containing no mineral oil.
2) Pulling tension shall be within the limits recommended by the wire and cable manufacturer.
3) Use a dynamometer where mechanical means are used.
4) Cut off section subject to mechanical means.
c. Bending Radius: Limit to 6 times cable overall diameter.
d. Slack: Provide maximum slack at all terminal points.
e. Splices:
1) Install cable continuous, without splice, from termination to termination.
2) Splices in conduits not allowed.
f. Identification: Identify all conductors by circuit number and phase at each terminal or splice location.
g. Color code power cables in accordance with OWNER'S standards.
2. Instrumentation Cable:
a. Install in conduit separate from power cables unless otherwise noted.
b. Ground shield on shielded cables at one end only.
c. Terminate stranded conductors with pre-insulated crimp type spade or ring torque terminals properly sized to fit fastening device and wire size.
d. Install and terminate vendor furnished cable in accordance with vendor equipment requirements.

D. Wiring Devices:
1. Outlet Boxes:
a. Fasten boxes rigidly and neatly to supporting structures.
b. For units mounted on masonry or concrete walls, provide suitable ½-inch spacers to prevent mounting back of box directly against wall.
c. Leave no open conduit holes in boxes. Close unused openings with capped bushings.
d. Label each circuit in boxes and identify with durable tag.
2. Snap Switches:
a. Install switches in outlet or device boxes in non-hazardous locations.
b. Install switches in rigid metallic conduit systems in hazardous locations.
c. Mount wall switches 4 feet 6 inches above finished floor unless otherwise noted.

3. Receptacles:
    a. Install receptacles in outlet or device boxes in non-hazardous locations.
    b. Install receptacles in rigid metallic conduit systems in hazardous locations.
    c. Install receptacles with ground pole in the down position.
    d. Mount receptacles 18 inches above finished floor in non-hazardous locations and 4 feet 6 inches above finished floor in hazardous locations unless otherwise noted.

E. Grounding Systems:
1. Equipment Grounding:
    a. Ground all electrical equipment in compliance with the National Electrical Code.
    b. Equipment grounding conductors shall be stranded copper cable of adequate size installed in conduit where necessary for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Color of insulation shall be green.
    c. Connect ground conductors to conduit with copper clamps, straps or with grounding bushings.
    d. Connect to piping by welding or brazing. Use copper bonding jumpers on all gasketed joints.
    e. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use holddown bolts. Where grounding provisions are not included, drill suitable holes in locations designated by ENGINEER.
    f. Connect to motors by bolting directly to motor frames, not to sole plates or supporting structures.
    g. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on all gasketed joints.
    h. Scrape bolted surfaces clean and coat with a conductive oxide-resistant compound.

F. Service and Distribution:
1. Lighting and Distribution Panelboards:
    a. Mounting: Install panelboards at locations shown on Drawings. Set cabinets so that top branch circuit breaker is not over 6 feet from the floor.
    b. Directory: Complete typewritten directory indicating items controlled by each circuit breaker and the size of feeder serving the panel.
    c. Arrange circuits to balance the loads on the panelboards.

3.02 INSPECTIONS, TESTING AND ADJUSTMENTS

A. Inspections: Accompany the normal installation tests with inspections to demonstrate to the satisfaction of the OWNER the following:
1. Connections: All circuits are properly connected in accordance with the Drawings and applicable approved Shop Drawings.
2. Operation: All circuits and devices are operable.
3. Identification: All conductors are properly identified at each terminal.

B. Testing:

1. 600 Volt Cable:
    a. Test each electrical circuit after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.
    b. Individually test 600 volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service with a Megger whose rating is suitable for the tested circuit.
    c. The insulation resistance for any given conductor shall not be less than 1 megohm for 600 volt and less service. Any cable not meeting this value or which fails when tested under full load conditions shall be replaced with a new cable for the full length.
2. Instrumentation Cable:
    a. Test shielded instrumentation cable shields with an ohmmeter for continuity along the full length of the cable and for shield continuity to ground.
    b. Connect shielded instrumentation cables to a calibrated 3-20 milliamp DC signal transmitter and receiver. Test at 4, 12, and 20 milliamp transmitter settings.
3. Grounding System:
    a. Test the completed ground systems for continuity and for resistance to ground using an electrical ground resistance tester. 50 mms
4. Operation Tests:
    a. Operate all circuit breakers and associated equipment to demonstrate suitability and compliance with Specifications and reference standards, except for short circuit interrupting rating or other inherent design features covered by shop tests.
    b. Test all motors and generators for direction of rotation and reverse connections if necessary.
    c. Check control circuits to determine that operation and sequence are correct and adjust limit switches, pressure switches, float switches, timers and other devices to give proper operation.
    d. All tests shall be witnessed by the Engineer.

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SECTION 16720
FIRE DETECTION AND ALARM SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work required under this Division shall include all materials, labor and auxiliaries required to furnish and install a complete 24 VDC, closed circuit, electrically supervised zone annunciated fire alarm system as specified herein, and indicated on the drawings.
The system shall include but not be limited to all control panels, power supplies, signal initiating devices, audible and visual alarm devices, wire fittings and all accessories required to provide a complete operating system. The system shall operate as a:
1. Non-coded, continuous ringing system which will sound all audible devices until it is manually silenced.
2. The system shall be wired as a Class B system for all circuits.
3. As built-drawings shall be provided as indicated

B. Contractor Qualifications: Contractor installing the fire alarm system shall be State of Florida licensed as an "Alarm System 1 Contractor" "EF" or "EC" designated.

C. Conduit and boxes to be installed by the electrical contractor. Alarm system wiring to be installed by the licensed alarm installer. Exception: If acceptable to the local authority having jurisdiction, wiring may be installed by the electrical contractor provided the alarm installer checks the wiring and accepts complete responsibility for the system and wiring.

D. Provide a point-by-point system check for supervision and device performance. Deliver NFPA-72 Certificate of Compliance to the owner with copy to the engineer. Deliver As-built drawings and checklist indicating proper operation of each device to the owner with copy to the engineer.

E. Contractor to advise Owner of requirements for monitoring the fire alarm system by Owner's monitoring company and provide all contacts and wiring required for remote monitoring (including tie to telephone lines).

F. Provide surge suppression on 120 volt power line, and data line protection at FACP for each signal line leaving the building housing the FACP. Provide other surge suppressors as required to meet one-year warranty.

G. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The Contractor shall provide and install all race-

ways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install fire-stopping where penetrations are made through rated walls and floors

H. The fire alarm installer shall be responsible for ensuring that prior to bidding the project; the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the fire alarm system manufacturer's recommendations for proper installation of the system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.

I. Surge Suppression

1. The Contractor shall have equipment installed on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes, which can cause damage to the microprocessor components of the system. Central office telephone lines shall have equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.
2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
3. Provide surge suppression equipment at the following locations:
    a) On each conductor pair and cable sheath entering or leaving a building.
    b) On each conductor associated with fire protection (sprinkler) system fire alarm connections.
    c) In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge protection equipment herein specified is required to be installed in addition to internal equipment protection.

J. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes, and in particular the ADA Requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant system. Said additional devices shall be shown on shop drawings submitted by Contractor.

1.02 DESCRIPTION:

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

C. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

E. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.03 VOICE PANEL DESCRIPTION:

A. The voice evacuation panel shall comply with NFPA 72, Chapter 24 requirements.

B. The Voice Evacuation Control Panel shall be UL 864 listed (Fire Protective Signaling), UL 2572 listed (Mass Notification), ULC listed and Compliant with Unified Facilities Criteria UFC 4-021-01.

C. The installing company shall employ factory-certified NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.04 WARRANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 5 years.

B. The Contractor shall warrant the equipment to be new and free from defects in ma-

terial and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.

1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

C. The Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance and provide for monitoring service with the County's current monitoring service company for one (1) year from date of final acceptance at no additional cost to the County.

D. Surge Suppression

1. All surge suppression devices shall be warranted free from defects in materials and workmanship for a period of five (5) years.
2. Any suppressor, which shows evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.
3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.05 QUAILITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years' experience and with service facilities within 50 miles of Project.

B. Installer:

1. Company specializing in installing the products specified in this section with minimum ten (10) years' experience.
2. The Installer shall be currently licensed as a Florida Certified Alarm System Contractor I (EF).
3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
5. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least ten (10) consecutive years going back from date of bid.

C. Surge Suppression

1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.

3. Verify proper clearances, space, etc. is available for surge suppressor.

D. Coordination/Project Conditions
   1. Verify proper grounding is in place.
   2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide a coupling conductor within the fire alarm underground raceway system to run alongside fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.

E. The work specified herein is an extension of the existing system and as such all equipment shall match existing. In the event that the existing equipment is no longer available other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the engineer:
   1. Certified letter from the manufacturer specifically stating the following:
      a) Part numbers and descriptions of each item that is no longer manufactured.
      b) Manufacturer name (if not the same as the original manufacturer), part numbers and descriptions of items that are certified by the manufacturer to be compatible with the existing system.
      c) A detailed listing of specific differences, including both advantages and disadvantages, between the original item and the proposed substitution.
   2. Contractor qualifications (as listed above).
   3. Complete lists, descriptions, and drawings of materials to be used.
   4. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
   5. A complete riser diagram of Fire Alarm System.

1.06 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 72	National Fire Alarm Code
No. 70	National Electric Code
No. 90A	Air Conditioning Systems

No. 101	Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1. The drawings and specifications herein comply with the best of the engineer's knowledge with all applicable codes at time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the Authority Having Jurisdiction.

1.07 APPROVALS:

A. The system shall have proper listing and / or approval from the following nationally recognized or regional agencies:

UL	Underwriters Laboratories, Inc
ULC	Underwriters Laboratories Canada
FM	Factory Mutual

1.08 SPARE PARTS:

A. Provide six (6) keys of each type.
B. Provide three (3) of each type of automatic smoke detector without base.

C. Provide three (3) of each type of surge suppression device.

PART 2.0 PRODUCTS

2.01 Main Fire Alarm Control Panel or Network Node

A. Main FACP or network node shall be a NOTIFIER Model NFS-320 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

2.02 System Capacity and General Operation

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. Each network node shall provide, or be capable of 318 intelligent / addressable devices per SLC loop.

C. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.

D. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire detection system.

E. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

F. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.

G. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.

H. The FACP or each network node shall provide the following features:

1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
2. Detector sensitivity test, meeting requirements of NFPA 72.
3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
4. Up to nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 0.5 to 2.35 percent per foot for photoelectric detectors, 0.5 to 2.5 percent per foot for ionization detectors, 0.5 to 4.0 percent per foot for acclimate detectors and 1.0 to 4.0 percent per foot for multi-criteria (IntelliQuad and IntelliQuad PLUS) detectors . The system shall also support sensitive advanced detection laser detectors with an alarm level range of .02 percent per foot to 2.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
5. The ability to display or print system reports.
6. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.

I. PAS presignal, meeting NFPA 72 requirements.

1. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
2. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
3. Control-by-time for non-fire operations, with holiday schedules.
4. Day / night automatic adjustment of detector sensitivity.
5. Device blink control for sleeping areas.

J. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."

K. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in

the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

1. This utility shall provide the ability to create and print NFPA style Test and Inspection reports
2. This utility shall provide the ability to create and print Device Maintenance information

L. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

M. Each FACP or FACP network node shall support one SLC. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric, multi-criteria, thermal, laser, fire/CO) and 159 intelligent modules (monitor, control, relay, releasing) for a loop capacity of 318 devices. SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.

N. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

2.03 Serial Interfaces

A. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.

B. EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.

C. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.

D. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

2.04 Specific System Operations

A. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the

sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

B. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

C. Point Disable: Any addressable device may be enabled or disabled through the system keypad.

D. Point Read: The system shall be able to display or print the following point status diagnostic functions:

1. Device status
2. Device type
3. Custom device label
4. View analog detector values
5. Device zone assignments

E. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.

F. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

G. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays.

The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.

H. Software Zones: The FACP shall support 142 independent programmable software zones.

I. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

J. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

K. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:

1. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
2. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
3. All devices tested in walk test shall be recorded in the history buffer.

2.05 Conventional Aspirating Detection

A. An optional air aspiration detection system shall be available.

B. The aspirating system shall support multiple sensitivity settings.

C. The aspirating system shall operate from 24 VDC.

D. The aspirating system shall provide alarm and trouble relays used to activate a fire alarm control panel.

2.06 Aspiration System Interface:

A. The system shall be capable of supporting Interface Modules for integrating VESDA Aspiration detectors into SLC loop of the fire alarm control panel. The Interface Module shall support up to 19 aspiration detectors, each SLC loop shall support one interface module.

2.07 High Level Aspiration System Interface:

A. The system shall be capable of supporting a High Level Interface for VESDA Aspirating Detection Systems. The interface shall support up to 100 detectors and allow the fire alarm network to monitor and control events on the aspiration system.

2.08 Communicators:

A. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

B. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.

C. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.

D. Communication shall include vital system status such as:

1. Independent Zone (Alarm, trouble, non-alarm, supervisory)
2. Independent Addressable Device Status
3. AC (Mains) Power Loss
4. Low Battery and Earth Fault
5. System Off Normal
6. 12 and 24 Hour Test Signal
7. Abnormal Test Signal (per UL requirements)
8. EIA-485 Communications Failure
9. Phone Line Failure

E. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

F. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.

G. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.

H. An IP or IP/GSM Communicator option shall be available to interface to the

UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

I. Smoke Control Annunciator

1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.09 Gateway & Webserver Options

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network

applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

E. Noti-Fire-Net Gateway: The system shall support an IP based gateway to enable the panel or local Noti-Fire-Net to be connected to an ONYXWorks workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display. The Noti-Fire-Net Gateway shall be available from the fire alarm control manufacturer.

F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager Utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.10 System Components & Addressable Devices

A. General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If re-

quired, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.
14. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status; NOTIFIER model # NBG-12LX They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. The key used to reset the pull station must be the

same as the key used to lock and unlock the FACP door(s).

15. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
16. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

B. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-851 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

C. Intelligent VIEW® Laser Photo Smoke Detector: The intelligent laser photo smoke detector shall be a spot type detector, NOTIFIER model # FSL-751, that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.

1. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
2. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.
3. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
4. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
5. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
6. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

D. Intelligent Ionization Smoke Detector: The intelligent ionization smoke detector shall be NOTIFIER model # FSI-851 and shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

E. Intelligent Multi Criteria Acclimating Detector: The intelligent multi-criteria Acclimate® Plus™ detector shall be an addressable device, NOTIFIER model # FAPT-851, that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal

properties all within a single sensing device.

1. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
2. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

F. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST- series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

G. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # DNR(W) and the remote test capable photoelectric smoke detector shall be NOTIFIER model # FSP-851R.

H. IntelliQuad™ Advanced Multi-Criteria Intelligent Detector

1. Intelligent multi-criteria fire detector shall be a NOTIFIER model number FSC-851. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate

sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.

3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.
4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.
7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.
8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall

be available to mount to standard junction boxes. Suitable boxes include:

a. 4.0" (10.16 cm) square box with and without plaster ring.
b. 4.0" (10.16 cm) octagonal box.
c. 3.5" (8.89 cm) octagonal box.
d. Single-gang box.

10. Meets Agency Standards
    a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
    b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
    c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

I. IntelliQuad™ PLUS Advanced Multi-Criteria Intelligent Fire/CO Detector

1. Advanced Multi-Criteria Fire/CO detector shall be NOTIFIER model # FCO-851 and shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.
2. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.
4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.
5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100 percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.
6. The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the

control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.

8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.
9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.
10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

    a. 4.0" (10.16 cm) square box with and without plaster ring.
    b. 4.0" (10.16 cm) octagonal box.
    c. 3.5" (8.89 cm) octagonal box.
    d. Single-gang box.
    e. Double-gang box

12. Meets Agency Standards

    a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
    b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
    c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling
    d. UL 2075 – Gas and Vapor Detector and Sensors – Systems Connected

J. Intelligent Addressable Aspiration Detector: The intelligent aspiration detector shall be NOTIFIER model # FSA-8000 or equivalent an addressable aspiration detector

that communicates directly with the fire alarm control panel via the SLC communication protocol, no modules or high level interfaces shall be required. The fire alarm control panel shall support up to thirty one intelligent aspiration detectors per SLC loop. The aspiration detector shall have dual source (blue LED and infra-red laser) optical smoke detection for a wide range of fire detection with enhanced immunity to nuisance particulates. The FACP shall be capable of monitoring and annunciating up to five smoke event thresholds and eleven trouble conditions. Each event threshold shall be capable of being assigned a discrete type ID at the FACP.

K. Intelligent Addressable Reflected Beam Detector: The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC).

L. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 or equivalent (Class A or B) or FMM-101 (Class B)
2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M or equivalent.

M. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device); NOTIFIER model # FZM-1 or equivalent.
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits; NOTIFIER model # XP6-MA or equivalent.

N. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1 or equivalent
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C or equivalent.

O. Addressable Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids; NOTIFIER model # FCM-1-REL or equivalent.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.

P. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1 or equivalent.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R or equivalent.

Q. Addressable Two-In / Two-Out Monitor/Relay Module:

1. An addressable Two-In / Two-Out module shall be available; NOTIFIER model # FDRM-1 or equivalent.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

R. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER

model # ISO-X or equivalent.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

S. Voice Evacuation Control Panel

1. The Voice Evacuation Control Panel shall be a NOTIFIER or equivalent First Command NFC-50/100 and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall distribute and control emergency voice messages over the speaker circuits.
2. The Voice Evacuation Control Panel shall be UL 864 listed (Fire Protective Signaling), UL 2572 listed (Mass Notification), ULC listed and Compliant with Unified Facilities Criteria UFC 4-021-01.
3. The system shall provide the capability to interface to distributed voice evacuation control panels from the same manufacturer.
4. The Voice Evacuation Control Panel shall be activated by the Fire Alarm Control Panel via a direct serial connection allowing the Fire Alarm Control panel to control speaker circuit(s) and message activation.
5. Shall have as minimum requirements:

    a. Integral 50 Watt, 25 Vrms audio amplifier with optional converter for 70.7-volt systems. The main system shall be capable of expansion to 100 watts total via the insertion of an additional 50 watt audio amplifier module into the same cabinet.
    b. Speaker circuit that can be wired both Class A and / or B.

6. Integral Digital Message Generator with a memory capacity for up to fourteen messages, each message shall be up 60 seconds long. These messages shall field programmable without the use of additional equipment.
7. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.
8. The Voice Control Panel will be capable of detecting and annunciating the following conditions: Loss of Power (AC and DC), System Trouble, Ground Fault, Alarm, Microphone Trouble, Message Generator Trouble, Tone Generator Trouble, and Amplifier Fault.
9. The Voice Control Panel shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generation.
10. Speaker outputs shall be fully power-limited.

11. Amplifiers will be supplied power independently to eliminate a short on one circuit from affecting other circuits.
12. The Voice Control Panel will provide full supervision on both active (alarm or music) and standby conditions.
13. Optional distributed amplifier units shall be available to increase total system capacity to up to 24 speaker circuits and up to 1,100 watts of power.

T. Advance Speakers

1. The Speaker appliance shall be System Sensor SpectrAlert or equivalent Advance model Speaker. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

U. Advance Speaker Strobes

1. The Speaker Strobe appliance shall be System Sensor SpectrAlert or equivalent Advance Speaker Strobe. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance speaker strobes and the Sync•Circuit™ Module MDL3 accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync•Circuit Module MDL3, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to

33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.
6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

PART 3.0 – EXECUTION

3.01 INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

E. Conductor: 98% conductivity, solid copper or stranded copper. If stranded conductors are used, then a compression lug shall be installed at every end. Wrapping

twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductors without crimp-on lugs may be terminated into terminal strips of box-lug connectors.

F. Insulation: A type accepted by NEC for the application. Individual conductors shall be Type THHN/THWN. All cable shall be UL listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types.

G. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:
   1. Multiplex Signaling Line Circuit: AWG #14, shielded twisted pair cable.
   2. Initiating Circuits, Hard-Wired Devices: AWG #14, THHN/THWN conductors.
   3. Notification Circuits: AWG #14, THHN/THWN conductors.
   4. Initiating Circuits, Addressable Devices: AWG #14, shielded twisted pair cable.
   5. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.

H. The above wire sizes shall be increased to size as required to comply with Authority Having Jurisdiction or as required for voltage drop, load, etc.

I. Color Coded:
   1. Wiring shall be color coded as required to match existing system.
   2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.

F. UL:
   1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
   2. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, Power Limited Fire Protective Signaling Cable. All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
   3. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760.179. All such cable shall bear a cable marking that includes a Type designation as given in NEC Table 760.179(I). Provide Type FPL.

G. Connections of Installation Wiring:
   1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
   2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
   3. Interconnecting means shall be arranged so that a single break or single

ground fault will not cause an alarm signal.

4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

3.02 TEST:

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow and tamper switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

L. When the system is equipped with a Voice Evacuation Control panel, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying voice messages.

M. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing

shall be in accordance with NFPA 72

3.03 FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

B. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing Form. The Inspection and Testing form format shall be as indicated in NFPA 72, Chapter 10, Figure 10.6.2.3 Inspection and Testing Form. When an Inspection and Testing Form has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.

C. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.04 INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.05 RECORD DRAWINGS:

A. In addition to the requirements above, the contractor shall submit:

1. Updated and revised contract documents to record actual locations (as-installed) of all equipment, devices, initiating devices, signaling appliances, and end-of-line devices.
2. Record actual type, size, and routing of cables installed.
3. Record all cable identifications.
4. Drawings required herein are in addition to those required under Operation and Maintenance Data.

5. All drawings required herein to be on AutoCAD Release 2010 or higher.

3.06 OPERATION AND MAINTENANCE:

A. Submit O & M Manuals shall include:

1. A complete as-installed equipment list, listed by room, with manufacturers'

names, model numbers, serial numbers, and quantities of each item.

2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and coding (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.
3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
4. Repair parts list for each and every major equipment item furnished.
5. Service manuals for each and every major equipment item furnished.
6. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.
7. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.
8. Surge Suppression
    a) O & M data to include:
        1. All accepted shop drawings, product data, and/or cut sheets.
        2. Installation, connection, and maintenance information on each type of surge suppression.
        3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.
9. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing detectors, speaker locations and orientation, rack locations, and all other related device locations.
10. The Contractor/Installer shall videotape the entire training session(s), and submit the video tape with the Operational Manual.

B. Drawings required herein are in addition to those required under Project Record Documents.

1. All drawings required herein shall be on AutoCAD Release 2010 or higher.

END OF SECTION

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Attachment A
Reports

Interoffice Memorandum

Orange County Risk Management
109 East Church Street, Suite 200
Orlando, Florida 32802-1393
Phone: (407) 836-9640 Fax: (407) 836-9630

DATE: Monday, October 13, 2014

TO: Travis Hollman, Engineer II, Utilities Engineering Division

FROM: Joel Howard, Environmental Loss Prevention Analyst
Risk Management Division

SUBJECT: **Report of Limited Pre-Demolition NESHAP Asbestos Survey**
Cypress Walk Water Supply Facility
60 Grand Cypress Boulevard
Orlando, Orange County, Florida
Parcel ID # 21-24-28-3125-00-080

Risk Management has reviewed and accepted the Limited Pre-Demolition NESHAP Asbestos Survey conducted by AMEC, dated October 9, 2014. The inspection was performed by an accredited inspector according to Federal regulation 49 CFR, Part 763 (AHERA).

Laboratory results indicated that none of the 9 suspect materials sampled contained asbestos fibers. No specialized abatement is required prior to demolition.

Supply the renovation contractor with the enclosed Limited Pre-Demolition NESHAP Asbestos Survey report. Risk Management approves the Limited Pre-Demolition NESHAP Asbestos Survey Report and will retain a copy of the report for future reference.

If you have any questions, please do not hesitate to contact me at (407) 836-9679.

Thank you,

Joel Howard, CIE, RPIH

Enclosure (1)

cc: Tisha Pence, Environmental Loss Prevention Coordinator, Risk Management

S:\Environmental\ENVIRONMENTAL PROJECTS\Multiple Water Supply Facilities\20141013 OCU Cypress Walk WST rpt pkg.doc

9 October 2014

Mr. Joel Howard
Environmental Loss Prevention Analyst
Orange County Risk Management
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Orlando, Florida 32802

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Fax: +1 (407) 239-2785
Email: joel.howard@ocfl.net

Subject: **Report of Limited Pre-Demolition NESHAP**
Chlorine Systems in Water Supply Facilities for Orange County Utilities
Cypress Walk WSF
60 Grand Cypress Boulevard
Orlando, Florida 32836
Parcel ID #21-24-28-3125-00-080
AMEC Project 6380-14-1230.21

Dear Mr. Howard,

AMEC Environment & Infrastructure, Inc. (AMEC) has completed the pre-demolition NESHAP asbestos sampling of the Cypress Walk Water Supply Facility (WSF) at 60 Grand Cypress Boulevard in Orlando, Florida. Specifically, the field survey was limited to pre-selected structures and associated equipment throughout the facility as indicated by OCU engineers. The survey was performed by Mr. Carver Gittens, an AHERA Accredited Inspector from AMEC. The field survey was conducted on 30 September 2014, in accordance with our Proposal 14PROP0010.6380.0430, Revision 1 dated 6 August 2014. The attached report gives a brief background of the project, the procedures used in the field and in laboratory analysis.

AMEC appreciates the opportunity to have been of assistance to you on this project and is looking forward to working with you as your consultant in the future. If you have any questions concerning this report or if we can be of further service, please contact us.

Respectfully,

AMEC Environment & Infrastructure, Inc.
Asbestos Business License No. ZA-0000449

Angel M. Vizcarrondo
Technical Professional

Russell E. Stauffer, P.E.
FL Asbestos Consultant
License No. EA0000016

Appendix A - Laboratory Reports

P:\6380 IEQ\PROJECTS\2014-Projects\1230 - OCRM VIII\1230.21 - OCRM Water Treatment Plants Chlorine Systems\1230.21 OCRM VIII Cypress WSF rpt.doc

Correspondence:
AMEC E&I (local address)
75 East Amelia Street, Suite 200
Orlando, Florida 32801 USA
Tel +1 (407) 522-7570
Fax +1 (407) 522-7576

1.0 PROJECT INFORMATION

Orange County Utilities (OCU) is removing the existing chlorine systems at the above mentioned water supply facility. The pre-demolition NESHAP survey was limited to materials which will be impacted during the removal of the chlorine system. The homogenization of the homogenous areas was based on the size and scope of the chlorine system removal observed by the licensed AHERA Inspector during the survey. Suspect materials included: adhesives, insulation, caulk, louvers, ceiling panels, CMU and mortar, shingles, stucco, eyewash station/shower, and concrete.

Information concerning this project was obtained from a walkthrough conducted on 10 July 2014 with representatives from AMEC (Mr. Angel Vizcarrondo and Mr. Carver Gittens), OCU (Mr. Travis Hollman) and Orange County Risk Management (Mr. Joel Howard). Additional information was obtained from the Orange County Property Appraiser's (OCPA's) website and from demolition drawings and pictures provided by OCU.

According to information obtained from OCPA's website, the structure was constructed in 1984. The interior walls of the structure are constructed of minimum inexpensive materials, while the exterior walls are concrete block and stucco.

The NESHAP asbestos survey included bulk sampling of suspect interior and exterior building materials, including when present, roofing products, concrete slabs/foundations/aboveground tank saddles, etc. ***Buried piping or equipment or other areas/structures which were not accessible to AMEC at the time of the site visit were not sampled.*** The structures and equipment are scheduled for demolition. No previous asbestos surveys have reportedly been conducted at the site.

The objective of AMEC's survey was to identify accessible asbestos-containing which may be impacted by the planned demolition of pre-selected structures in the Oak Meadows Water Supply Facility.

2.0 SURVEY PROCEDURES

The survey was performed by observing accessible building materials and coatings. Bulk and chip sampling of suspect ACM was limited to accessible building materials, which might be impacted by the planned demolition of pre-selected structures and equipment.

3.0 LIMITED ASBESTOS BULK SAMPLING

3.1 General

The bulk sampling procedures utilized for the collection of suspect materials first required the establishment of a homogeneous sampling area. A homogeneous sampling area is defined as an area of the same type and applied during the same general time period. The individual sampling areas were then examined and representative samples of the suspect materials were obtained. Bulk samples collected during the survey were delivered to EMSL Analytical, Inc., of Orlando, Florida, an NVLAP accredited laboratory (No. 10115-0). The bulk samples were analyzed by Polarized Light microscopy (PLM) coupled with dispersion staining in accordance with EPA Method 600/R-93/116.

Polarized Light Microscopy (PLM) is an analytical method for asbestos identification which depends on the unique optical properties of mineral forms in the samples, and specifically identifies the various asbestos types. This is the referenced method of analysis by EPA for asbestos identification in bulk samples. Materials found to contain greater than one percent asbestos by PLM are Asbestos-Containing Materials (ACM) as defined by EPA, OSHA and the State of Florida.

The EPA National Standard for Hazardous Air Pollutants (NESHAP) Final Rule (40 CFR 61, Subpart M) for asbestos includes an option for verification of friable materials, by point counting, if it is initially determined by PLM analysis that asbestos is present in amounts less than 10 percent. Point Counts were **not** conducted as part of the asbestos NESHAP survey.
The following suspect materials (thought to possibly contain asbestos) were sampled during the survey at the Cypress Walk WSF:

1. Concrete Masonry Unit (CMU) and Mortar - (North, East & South Chemical Building Walls)
2. Concrete – (Chemical Building Slab and Tank Pad)
3. Stucco - (Chemical Building North, West & South Exterior Walls)
4. Coating Gray – (Fluoride Bldg. Floor)
5. Stucco - (Fluoride Building West, South & East Exterior Walls)
6. Caulk Off-White - (Fluoride Bldg. Siding Seams)
7. Concrete – (Fluoride Building Slab)

3.2 Asbestos Analytical Results

Based upon our visual observations, bulk sampling of 7 suspect materials (17 samples and 17 layers) and subsequent PLM microscopic analysis, the previously identified suspect materials were ***not*** determined to contain regulated amounts of asbestos.

A copy of the asbestos laboratory analysis is included in Appendix A.

3.3 Asbestos Conclusions and Recommendations

Since the pre-selected structures will be demolished, a ten day working day written notification is required prior to the start of demolition activities under the EPA NESHAP regulation (40 CFR 61, Subpart M) and Florida Department of Environmental Protection (FDEP) rules. The subject project is located in ***Orange County*** so notification should be made to the Florida Department of Environmental Protection (FDEP) Central District Office at 3319 Maguire Boulevard, Suite 232, Orlando, Florida 32803-3767, Phone (407) 894-7555, Fax (407) 897-2966, using FDEP Form 62-0257.900(1).

4.0 LIMITATIONS

AMEC has performed its services in accordance with generally accepted practices at the time of the field work. This report has been prepared on behalf of and exclusively for the use by ***Orange County Risk Management and Orange County Utilities Engineering***. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party without AMEC's prior written consent. The findings are relative to the date of our site visit and should not be relied upon for substantially later dates. All material quantities are estimated based on visual observation and should be relied on for contractor bidding or regulatory notification purposes.

Please note that these test results relate only to those homogeneous materials tested. If conditions, or materials, other than those addressed in this report are encountered during the planned maintenance, renovation, or demolition activities, AMEC should be contacted to assess the potential impact of these materials or conditions relative to the findings or recommendations included herein.

APPENDIX A

LABORATORY ANALYSIS

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341408700
CustomerID:	AMECH25
CustomerPO:	C012306785
ProjectID:	

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/2/2014
Collected:	9/30/2014

Project: **6380-14-1230.21 Cypress Walk WSF**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-1A *341408700-0001*	North - CMU & Mortar	Gray Non-Fibrous Heterogeneous		60% Quartz 10% Ca Carbonate 30% Non-fibrous (other)	**None Detected**
		Inseparable materials, composite analysis.			
B-1B *341408700-0002*	East - CMU & Mortar	Gray Non-Fibrous Heterogeneous		60% Quartz 10% Ca Carbonate 30% Non-fibrous (other)	**None Detected**
		Inseparable materials, composite analysis.			
B-1C *341408700-0003*	South - CMU & Mortar	Gray Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
		Inseparable materials, composite analysis.			
B-2A *341408700-0004*	Main Slab - Concrete	Gray Non-Fibrous Heterogeneous		35% Quartz 10% Ca Carbonate 55% Non-fibrous (other)	**None Detected**
B-2B *341408700-0005*	Pad For Tanks - Concrete	Gray Non-Fibrous Heterogeneous		40% Quartz 10% Ca Carbonate 50% Non-fibrous (other)	**None Detected**
B-3A *341408700-0006*	North - Stucco	Gray/Tan Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
		Inseparable paint / coating layer included in analysis			
B-3B *341408700-0007*	West - Stucco	Gray/Tan Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
		Inseparable paint / coating layer included in analysis			

Initial report from 10/06/2014 11:37:50

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341408700
CustomerID:	AMECH25
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ProjectID:	

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/2/2014
Collected:	9/30/2014

Project: **6380-14-1230.21 Cypress Walk WSF**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-3C *341408700-0008*	South - Stucco	Gray/Tan Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-4A *341408700-0009*	Floor - Gray Floor Coating	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-4B *341408700-0010*	Floor - Gray Floor Coating	Gray/Tan Fibrous Heterogeneous	2% Glass	98% Non-fibrous (other)	**None Detected**
			Result includes a small amount of inseparable attached material		
B-5A *341408700-0011*	West - Stucco	Gray/Tan Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-5B *341408700-0012*	South - Stucco	Gray/Tan Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-5C *341408700-0013*	East - Stucco	Gray/Beige Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-6A *341408700-0014*	Seams Of Siding West - Off White Caulk	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		

Initial report from 10/06/2014 11:37:50

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EMSL Order:	341408700
CustomerID:	AMECH25
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Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/2/2014
Collected:	9/30/2014

Project: **6380-14-1230.21 Cypress Walk WSF**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-6B *341408700-0015*	Seams Of Siding South - Off White Caulk	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-7A *341408700-0016*	Slab - Concrete	Gray Non-Fibrous Heterogeneous		35% Quartz 15% Ca Carbonate 50% Non-fibrous (other)	**None Detected**
B-7B *341408700-0017*	Slab - Concrete	Gray Non-Fibrous Heterogeneous		35% Quartz 10% Ca Carbonate 55% Non-fibrous (other)	**None Detected**

Initial report from 10/06/2014 11:37:50

EMSL Analytical, Inc.
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Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341408700
CustomerID:	AMECH25
CustomerPO:	C012306785
ProjectID:	

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/2/2014
Collected:	9/30/2014

Project: **6380-14-1230.21 Cypress Walk WSF**

The samples in this report were submitted to EMSL for analysis by Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy. The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date::	10/1/2014	Sample Receipt Time:	5:00 PM
Analysis Completed Date:	10/2/2014	Analysis Completed Time:	12:05 PM

Analyst(s):

Katelyn Wright PLM (7)

Manolo Hernandez PLM (10)

Samples reviewed and approved by:

Jonathan Teda, Asbestos Lab Manager
or other approved signatory

Initial report from 10/06/2014 11:37:50

Interoffice Memorandum

Orange County Risk Management
109 East Church Street, Suite 200
Orlando, Florida 32802-1393
Phone: (407) 836-9640 Fax: (407) 836-9630

DATE: Monday, October 13, 2014

TO: Travis Hollman, Engineer II, Utilities Engineering Division

FROM: Joel Howard, Environmental Loss Prevention Analyst
Risk Management Division

SUBJECT: **Report of Limited Pre-Demolition NESHAP Asbestos Survey**
Orangewood Water Supply Facility
5707 Sea Splash Way
Orlando, Orange County, Florida
Parcel ID # 07-24-29-5844-00-200

Risk Management has reviewed and accepted the Limited Pre-Demolition NESHAP Asbestos Survey conducted by AMEC, dated October 9, 2014. The inspection was performed by an accredited inspector according to Federal regulation 49 CFR, Part 763 (AHERA).

Laboratory results indicated that none of the 9 suspect materials sampled contained asbestos fibers. No specialized abatement is required prior to demolition.

Supply the renovation contractor with the enclosed Limited Pre-Demolition NESHAP Asbestos Survey report. Risk Management approves the Limited Pre-Demolition NESHAP Asbestos Survey Report and will retain a copy of the report for future reference.

If you have any questions, please do not hesitate to contact me at (407) 836-9679.

Thank you,

Joel Howard, CIE, RPIH

Enclosure (1)

cc: Tisha Pence, Environmental Loss Prevention Coordinator, Risk Management

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(2)

9 October 2014

Mr. Joel Howard
Environmental Loss Prevention Analyst
Orange County Risk Management
109 East Church Street, Suite 200
Orlando, Florida 32802

Phone: +1 (407) 836-9679
Fax: +1 (407) 239-2785
Email: joel.howard@ocfl.net

Subject: **Report of Limited Pre-Demolition NESHAP Asbestos Survey**
Chlorine System in Water Supply Facility for Orange County Utilities
Orangewood WSF
5707 Sea Splash Way
Orlando, Florida 32821
Parcel ID #07-24-29-5844-00-200
AMEC Project 6380-14-1230.21

Dear Mr. Howard,

AMEC Environment & Infrastructure, Inc. (AMEC) has completed the pre-demolition NESHAP asbestos sampling of the Orangewood Water Supply Facility (WSF) at 5707 Sea Splash Way in Orlando, Florida. Specifically, the field survey was limited to pre-selected structures and associated equipment throughout the facility as indicated by OCU engineers. The survey was performed by Mr. Carver Gittens, an AHERA Accredited Inspector from AMEC. The field survey was conducted on 30 September 2014, in accordance with our Proposal 14PROP0010.6380.0430, Revision 1 dated 6 August 2014. The attached report gives a brief background of the project, the procedures used in the field and in laboratory analysis.

AMEC appreciates the opportunity to have been of assistance to you on this project and is looking forward to working with you as your consultant in the future. If you have any questions concerning this report or if we can be of further service, please contact us.

Respectfully,

AMEC Environment & Infrastructure, Inc.
Asbestos Business License No. ZA-0000449

Angel M. Vizcarrondo
Technical Professional

Russell E. Stauffer, P.E.
FL Asbestos Consultant
License No. EA0000016

Appendix A - Laboratory Reports

P:\6380 IEQ\PROJECTS\2014-Projects\1230 - OCRM VIII\1230.21 - OCRM Water Treatment Plants Chlorine Systems\1230.21 OCRM VIII Orangewood WSF rpt.doc

Correspondence:
AMEC E&I (local address)
75 East Amelia Street, Suite 200
Orlando, Florida 32801 USA
Tel +1 (407) 522-7570
Fax +1 (407) 522-7576

1.0 PROJECT INFORMATION

Orange County Utilities (OCU) is removing the existing chlorine systems at the above mentioned water supply facility. The pre-demolition NESHAP survey was limited to materials which will be impacted during the removal of the chlorine system. The homogenization of the homogenous areas was based on the size and scope of the chlorine system removal observed by the licensed AHERA Inspector during the survey. Suspect materials included: adhesives, insulation, caulk, louvers, ceiling panels, CMU and mortar, shingles, stucco, eyewash station/shower, and concrete.

Information concerning this project was obtained from a walkthrough conducted on 10 July 2014 with representatives from AMEC (Mr. Angel Vizcarrondo and Mr. Carver Gittens), OCU (Mr. Travis Hollman) and Orange County Risk Management (Mr. Joel Howard). Additional information was obtained from the Orange County Property Appraiser's (OCPA's) website and from demolition drawings and pictures provided by OCU.

According to information obtained from OCPA's website, the structure was constructed in 1974. The interior walls of the structure are constructed of minimum inexpensive materials, while the exterior walls are concrete and cinder block.

The NESHAP asbestos survey included bulk sampling of suspect interior and exterior building materials, including when present, roofing products, concrete slabs/foundations/aboveground tank saddles, etc. ***Buried piping or equipment or other areas/structures which were not accessible to AMEC at the time of the site visit were not sampled.*** The structures and equipment are scheduled for demolition. No previous asbestos surveys have reportedly been conducted at the site.

The objective of AMEC's survey was to identify accessible asbestos-containing materials which may be impacted by the planned demolition of pre-selected structures in the Orangewood Water Supply Facility.

2.0 SURVEY PROCEDURES

The survey was performed by observing accessible building materials and coatings. Bulk sampling of suspect ACM was limited to accessible building materials, which might be impacted by the planned demolition of pre-selected structures and equipment.

3.0 LIMITED ASBESTOS BULK SAMPLING

3.1 General

The bulk sampling procedures utilized for the collection of suspect materials first required the establishment of a homogeneous sampling area. A homogeneous sampling area is defined as an area of the same type and applied during the same general time period. The individual sampling areas were then examined and representative samples of the suspect materials were obtained. Bulk samples collected during the survey were delivered to EMSL Analytical, Inc., of Orlando, Florida, an NVLAP accredited laboratory (No. 10115-0). The bulk samples were analyzed by Polarized Light microscopy (PLM) coupled with dispersion staining in accordance with EPA Method 600/R-93/116.

Polarized Light Microscopy (PLM) is an analytical method for asbestos identification which depends on the unique optical properties of mineral forms in the samples, and specifically identifies the various asbestos types. This is the referenced method of analysis by EPA for asbestos identification in bulk samples. Materials found to contain greater than one percent asbestos by PLM are Asbestos-Containing Materials (ACM) as defined by EPA, OSHA and the State of Florida.

The EPA National Standard for Hazardous Air Pollutants (NESHAP) Final Rule (40 CFR 61, Subpart M) for asbestos includes an option for verification of friable materials, by point counting, if it is initially determined by PLM analysis that asbestos is present in amounts less than 10 percent. Point Counts were **not** conducted as part of the asbestos NESHAP survey.
The following suspect materials (thought to possibly contain asbestos) were sampled during the survey at the Orangewood WSF:

1. Stucco - (Chemical & Analyzer Building North, West & South Exterior Walls)
2. Concrete – (Chemical Section Slab and Tank Pad)
3. Concrete Masonry Unit (CMU) and Mortar - (South, West & East Chemical Section Ext. Walls)
4. Gray Coating – (Chemical Section Floor)
5. Caulk Gray – (Around Interior Windows)
6. Concrete – (Fluoride Section Tank Pad)
7. Concrete Panels with Stucco Texture – (South & East Exterior Walls)
8. Caulk White – (Fluoride Section Seams of Siding Panels)
9. Gray Coating – (Fluoride Section Floor)

3.2 Asbestos Analytical Results

Based upon our visual observations, bulk sampling of **9** suspect materials (21 samples and 21 layers) and subsequent PLM microscopic analysis, the previously identified suspect materials were determined **not** to contain regulated amounts of asbestos.

A copy of the asbestos laboratory analysis is included in Appendix A.

3.3 Asbestos Conclusions and Recommendations

Since the pre-selected structures will be demolished, a ten day working day written notification is required prior to the start of demolition activities under the EPA NESHAP regulation (40 CFR 61, Subpart M) and Florida Department of Environmental Protection (FDEP) rules. The subject project is located in ***Orange County*** so notification should be made to the Florida Department of Environmental Protection (FDEP) Central District Office at 3319 Maguire Boulevard, Suite 232, Orlando, Florida 32803-3767, Phone (407) 894-7555, Fax (407) 897-2966, using FDEP Form 62-0257.900(1).

4.0 LIMITATIONS

AMEC has performed its services in accordance with generally accepted practices at the time of the field work. This report has been prepared on behalf of and exclusively for the use by ***Orange County Risk Management and Orange County Utilities Engineering***. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party without AMEC's prior written consent. The findings are relative to the date of our site visit and should not be relied upon for substantially later dates. All material quantities are estimated based on visual observation and should be relied on for contractor bidding or regulatory notification purposes.

Please note that these test results relate only to those homogeneous materials tested. If conditions, or materials, other than those addressed in this report are encountered during the planned maintenance, renovation, or demolition activities, AMEC should be contacted to assess the potential impact of these materials or conditions relative to the findings or recommendations included herein.

APPENDIX A

LABORATORY ANALYSIS

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341408756
CustomerID:	AMECH25
CustomerPO:	C012306785
ProjectID:	Orange County Risk

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

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Received:	10/01/14 5:00 PM
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Collected:	9/30/2014

Project: **6380-14-1230.21 Orangewood WSF**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-1A *341408756-0001*	East - Stucco	Gray/White/Beige Non-Fibrous Heterogeneous		40% Quartz 10% Ca Carbonate 50% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-1B *341408756-0002*	South - Stucco	Gray/White/Beige Non-Fibrous Heterogeneous		40% Quartz 10% Ca Carbonate 50% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-1C *341408756-0003*	North Wall - Stucco	Gray/White Non-Fibrous Heterogeneous		45% Quartz 10% Ca Carbonate 45% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-2A *341408756-0004*	Slab - Concrete	Gray Non-Fibrous Heterogeneous		45% Quartz 15% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-2B *341408756-0005*	Tank Pad - Concrete	Gray Non-Fibrous Heterogeneous		45% Quartz 10% Ca Carbonate 45% Non-fibrous (other)	**None Detected**
B-3A *341408756-0006*	South - CMU & Mortar	Gray Non-Fibrous Heterogeneous		40% Quartz 10% Ca Carbonate 50% Non-fibrous (other)	**None Detected**
			Inseparable materials. Composite analysis.		

Initial report from 10/06/2014 11:32:45

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CustomerPO:	C012306785
ProjectID:	Orange County Risk

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/3/2014
Collected:	9/30/2014

Project: **6380-14-1230.21 Orangewood WSF**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-3B *341408756-0007*	West - CMU & Mortar	Gray Non-Fibrous Heterogeneous		40% Quartz 10% Ca Carbonate 50% Non-fibrous (other)	**None Detected**
			Inseparable materials. Composite analysis.		
B-3C *341408756-0008*	East - CMU & Mortar	Gray Non-Fibrous Heterogeneous		45% Quartz 10% Ca Carbonate 45% Non-fibrous (other)	**None Detected**
			Inseparable materials. Composite analysis.		
B-4A *341408756-0009*	Floor - Gray Coating	Gray Non-Fibrous Heterogeneous		35% Quartz 5% Ca Carbonate 60% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-4B *341408756-0010*	Floor - Gray Coating	Gray Non-Fibrous Heterogeneous		30% Quartz 5% Ca Carbonate 65% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-5A *341408756-0011*	Around Interior Windows - Gray Caulk	Gray Non-Fibrous Heterogeneous	5% Cellulose	95% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-5B *341408756-0012*	Around Interior Windows - Gray Caulk	Gray Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-6A *341408756-0013*	Tank Pad - Concrete	Gray Non-Fibrous Heterogeneous		45% Quartz 10% Ca Carbonate 45% Non-fibrous (other)	**None Detected**

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Initial report from 10/06/2014 11:32:45

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341408756
CustomerID:	AMECH25
CustomerPO:	C012306785
ProjectID:	Orange County Risk

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/3/2014
Collected:	9/30/2014

Project: **6380-14-1230.21 Orangewood WSF**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-6B *341408756-0014*	Tank Pad - Concrete	Gray Non-Fibrous Heterogeneous		20% Ca Carbonate 80% Non-fibrous (other)	**None Detected**
B-7A *341408756-0015*	South Wall - Concrete Panels w/Stucco Texture Over	Gray/Beige Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable materials. Composite analysis.		
B-7B *341408756-0016*	East Wall - Concrete Panels w/Stucco Texture Over	Gray/Beige Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable materials. Composite analysis.		
B-7C *341408756-0017*	East Wall - Concrete Panels w/Stucco Texture Over	Gray Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable materials. Composite analysis.		
B-8A *341408756-0018*	Seams Of Siding Panels West Sect - White Caulk	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-8B *341408756-0019*	Seams Of Siding Panels North Sect - White Caulk	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-9A *341408756-0020*	Floor - Gray Coating	Gray Non-Fibrous Heterogeneous		40% Quartz 5% Ca Carbonate 55% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		

10

Initial report from 10/06/2014 11:32:45

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
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EMSL Order:	341408756
CustomerID:	AMECH25
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ProjectID:	Orange County Risk

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/3/2014
Collected:	9/30/2014

Project: **6380-14-1230.21 Orangewood WSF**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-9B *341408756-0021*	Floor - Gray Coating	Gray Non-Fibrous Heterogeneous		35% Quartz 5% Ca Carbonate 60% Non-fibrous (other)	**None Detected**

Inseparable paint / coating layer included in analysis

nl

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Reporting limit is 1%

Samples analyzed by EMSL Analytical, Inc. Orlando, FL NVLAP Lab Code 101151-0

Initial report from 10/06/2014 11:32:45

Interoffice Memorandum

Orange County Risk Management
109 East Church Street, Suite 200
Orlando, Florida 32802-1393
Phone: (407) 836-9640 Fax: (407) 836-9630

DATE: Tuesday, October 21, 2014

TO: Travis Hollman, Engineer II, Utilities Engineering Division

FROM: Joel Howard, Environmental Loss Prevention Analyst
Risk Management Division

SUBJECT: **Report of Limited Pre-Demolition NESHAP Asbestos Survey**
Hunters Creek WSF
14000 Water Plant Drive
Orange County, Florida

Risk Management has reviewed and accepted the Limited Pre-Demolition NESHAP Asbestos Survey conducted by AMEC, dated October 17, 2014. The inspection was performed by an accredited inspector according to Federal regulation 49 CFR, Part 763 (AHERA).

Laboratory results indicated that one of the ten suspect materials was found to contain asbestos fibers which included exterior caulk.

The exterior caulk is considered a Category I Non-Friable Asbestos Containing Material (ACM). AMEC states that the material may remain in-place during demolition provided the demolition contractor is qualified as an asbestos-abatement contractor; uses qualified workers; does not cut, sand, grind or abrade. Risk Management recommends that the material be removed prior to demolition in an effort to maximize recyclable materials.

Risk Management requires that the demo contractor follow AMEC's recommendations. Supply the demolition and abatement contractors with the enclosed Pre-Demolition NESHAP Asbestos Survey report. Risk Management requests that the demolition be conducted using wet methods. Risk Management approves the Pre-Demolition NESHAP Asbestos Survey report and will retain a copy of the report for future reference.

If you have any questions, please do not hesitate to contact me at (407) 836-9679.

Thank you,

Joel Howard, CIE, RPIH

Enclosure (1)

cc: Tisha Pence, Environmental Loss Prevention Coordinator, Risk Management

S:\Environmental\ENVIRONMENTAL PROJECTS\Multiple Water Supply Facilities\20141021 OCU Hunters Creek WSF rpt memo.doc

17 October 2014

Joel Howard, CIE, RPIH
Orange County Risk Management
109 East Church Street, Suite 200
Orlando, Florida 32801

Phone: +1 (407) 836-9679
Cell: +1 (321) 239-2785
Fax: +1 (407) 836-9630
Email: joel.howard@ocfl.net

Subject: **Report of Pre-Demolition NESHAP Asbestos Survey**
Chlorine Systems in Multiple Supply Facilities for Orange County Utilities
Hunters Creek WSF
14000 Water Plant Drive
Orlando, Florida 32837
AMEC Project 6380-14-1230.21

Dear Mr. Howard,

AMEC Environment & Infrastructure, Inc. (AMEC) has completed the Pre-Demolition NESHAP Asbestos Survey within the above referenced facility. The field survey was performed by Mr. Carver Gittens, an AHERA Accredited Inspector from AMEC, on 10 October 2014, in accordance with our Proposal 14PROP0010.6380.0430, dated 6 August 2014.

The attached report gives a brief background of the project, the procedures used in the field and in laboratory analysis. A summary of the laboratory analyses is included as an attachment.

AMEC appreciates the opportunity to have been of assistance to you on this project and is looking forward to working with you as your consultant in the future. If you have any questions concerning this report or if we can be of further service, please contact us.

Respectfully,

AMEC Environment & Infrastructure, Inc.
Asbestos Business License No. ZA-0000449

Angel M. Vizcarrondo
Technical Professional

Russell E. Stauffer, P.E.
FL Asbestos Consultant
License No. EA0000016

Attachments: Laboratory Reports

P:\6380 IEQ\PROJECTS\2014-Projects\1230 - OCRM VIII\1230.21 - OCRM Hunters Creek WSF - NESHAP Report.doc

Correspondence:
AMEC Environment & Infrastructure, Inc.
75 East Amelia Street, Suite 200
Orlando, Florida 32801 USA
Tel +1 (407) 522-7570
Fax +1 (407) 522-7576

1.0 PROJECT INFORMATION

Orange County Utilities (OCU) is removing the existing chlorine systems at the above mentioned water plants. The limited pre-demolition NESHAP surveys was limited to materials which at to be impacted during the removal of the chlorine system (which includes a single fiberglass building at Oak Meadows Water Supply Facility). Based on the size and scope of the chlorine system removal, the homogenization of the homogenous areas observed was at the discretion of the licensed AHERA Inspector conducting the survey. Suspect materials include: adhesives, insulation, caulk, louvers, ceiling panels, concrete masonry units (CMU) and mortar, shingles, stucco, eyewash station/shower, and concrete.

Information concerning this project was obtained from a walkthrough conducted on 10 July 2014 with representatives from AMEC (Mr. Angel Vizcarrondo and Mr. Carver Gittens), OCU (Mr. Travis Hollman) and Orange County Risk Management (Mr. Joel Howard). Additional information also came from demolition drawings and pictures provided by OCU.

The facilities are located at the following addresses:

Oak Meadows WSF
226 Dorscher Road
Orlando, FL 32835

Hunters Creek WSF
14000 Water Plant Drive
Orlando, FL 32837

Cypress Walk WSF
60 Grand Cypress Boulevard
Orlando, FL 32836

Orangewood WSF
5707 Sea Splash Way
Orlando, FL 32821

The objective of AMEC's survey was to identify accessible asbestos-containing materials which may be impacted by the planned demolition of the structures.

2.0 SURVEY PROCEDURES

2.1 General

The survey was performed by observing accessible exposed building materials and included bulk sampling of suspect i building materials likely to be impacted during the removal of the chlorine system. We must emphasize that it is not possible to look within every location of a building. The visual survey documents only general locations of suspect materials but does not determine exact boundaries.

No attempt was made to disassemble equipment or demolish structural elements, equipment, tanks and finishes, as this is beyond the scope of our authorized services. Visual observations were made at convenient locations and due to these limitations, wall voids, building cavities and mechanical equipment, and other areas may contain unreported asbestos-containing materials.

2.2 Bulk Sampling

The bulk sampling procedures utilized for the collection of suspect materials first required the establishment of a homogeneous sampling area. A homogeneous sampling area is defined as an area of the same type and applied during the same general time period. The individual sampling areas were then examined and representative samples of the suspect materials were obtained. Bulk samples collected during the survey were delivered to EMSL Analytical, Inc., of Orlando, Florida, an NVLAP accredited laboratory (No. 10115-0). The bulk samples were analyzed by Polarized Light microscopy (PLM) coupled with dispersion staining in accordance with EPA Method 600/R-93/116.

Polarized Light Microscopy (PLM) is an analytical method for asbestos identification which depends on the unique optical properties of mineral forms in the samples, and specifically identifies the various asbestos types. This is the referenced method of analysis by EPA for asbestos identification in bulk samples. Materials found to contain greater than one percent asbestos by PLM are Asbestos-Containing Materials (ACM) as defined by EPA, OSHA and the State of Florida.

The EPA National Standard for Hazardous Air Pollutants (NESHAP) Final Rule (40 CFR 61, Subpart M) for asbestos includes an option for verification of friable materials, by point counting, if it is initially determined by PLM analysis that asbestos is present in amounts less than 10 percent. Point Counting was **not** part of this survey.

The following suspect materials (thought to possibly contain asbestos) were sampled during the survey. Materials containing asbestos are in **bold**:

1. **Peach Caulk** (North & South Chemical building exterior Walls)
2. Concrete Masonry Unit (CMU) and Mortar (North, East & West Chemical Building ext. Walls)
3. Brown Caulk (Chemical Building, around windows)
4. White Caulk (Chemical Building Interior Wall Joints/Seams)
5. Gray Coating (Chemical Building Tank Pad)
6. Peach Coating, Granular (Chemical Building Floor)
7. Concrete (Chemical Building Tank Pad)
8. Gray Coating (Fluoride Building Slab and Tank Pad)
9. Stucco (Fluoride Building, North Interior and West Exterior)
10. Concrete Fluoride Building Tank Pad and Building Slab)

3.0 BULK SAMPLE RESULTS

Based upon our visual observations, bulk sampling of 10 suspect materials (22 samples, 22 layers) and subsequent PLM microscopic analysis, the following material was determined to contain asbestos:

Sample No.	Material Sampled	Sample Location	Percent/ Type Asbestos	Condition/ Potential for Damage	Estimated Quantity
B-1A B-1B	Exterior Peach Caulk	Wall Seams (North and South)	**2% Chrysotile**	Fair/Moderate	100 L. F.

L. F. – Linear Feet

Prepared By: AMV Checked By: RES

4.0 ASBESTOS CONCLUSIONS

4.1 General Recommendations

There are four recognized alternative courses of action to control asbestos-containing materials in buildings: (1) asbestos removal and disposal; (2) enclosure; (3) encapsulation; and, (4) special operations, maintenance and re-observation programs. The selection of a particular alternative should be based upon intended usage of the building, actual exposure rates and cost.

Regarding Item No. 1, the EPA has Federal regulations regarding asbestos. The National Emissions Standard for Hazardous Air Pollutants (NESHAP) Final Rule Revision (EPA 40 CFR Part 61) dated November 20, 1990 includes several requirements for building Owners and Contractors. The requirement that greatly affects abatement alternatives is the categorization of asbestos-containing materials (ACM).

These are categorized as follows:

- **Friable** means any material that can be reduced to powder by hand pressure when dry.
- **Category I Non-Friable ACM** means packing, gaskets, resilient floor coverings and roofing products that contain more than one- percent asbestos.
- **Category II Non-Friable ACM** means any material, excluding Category I Non-Friable ACM that contains more than one- percent asbestos, and is not friable.
- **Regulated ACM (RACM)** includes all friable ACM; Category I Non-Friable ACM that will be or has been subject to sanding, grinding, cutting or abrading; Category I Non-Friable ACM that has become friable; and Category II Non-Friable ACM that has a high probability of becoming, or has become crumbled, pulverized, or reduced to a powder by forces expected to act on the material in the course of demolition or renovation operations.

4.2 Specific Asbestos Recommendations

4.2.1 Peach Caulk in Exterior Frames of Windows and Doors

The peach caulk (Samples B-1A and B-1B) was found to contain **2% Chrysotile asbestos.** The EPA NESHAP (40 CFR Part 61, Subpart M) classifies caulk as Category I, non-friable ACM. Approximately 100 linear feet of peach ACM caulk in Fair Condition with a Moderate Potential for Damage, was noted on exterior wall seams of the Chemical Building.

4.2.2 Asbestos Containing Materials Overview

The OSHA Construction Standard (29 CFR 1926.1101) classifies disturbance, removal, or demolition of structures with ***ACM Caulk*** as Class II asbestos work which requires specialized training, engineering controls, etc.

However, this Category I non-friable asbestos-containing material **need not be removed** prior to demolition if Orange County uses a demolition contractor that is also qualified as an asbestos-abatement contractor; uses qualified asbestos workers; and does not cut, sand, grind or abrade

the ACM caulk. If these conditions are met, the Category I non-friable material may be demolished in place, utilizing wet methods **provided it will not be exposed to cutting, sanding, grinding, abrading or otherwise rendered friable by the demolition activities.**

4.3 State Of Florida Asbestos Regulations

Chapter 469 of the Florida Statutes generally requires that a state licensed asbestos abatement contractor perform the removal, repair, or encapsulation of the types of ACM and materials identified as containing asbestos in this report.

Since the structure will be demolished, ten working day written notification is required prior to the start of demolition activities under the EPA NESHAP regulation (40 CFR 61, Subpart M) and Florida Department of Environmental Protection (FDEP) rules. Since the project is located in Orange County, the notification, using FDEP form 62-257.900(1), must be made to FDEP's Central District Office at 3319 Maguire Boulevard, Suite 232, Orlando, FL 32803-3767 (telephone 407-894-7555, Fax 407-897-2966).

4.4 Interim Measures

Regardless of the type of asbestos abatement action chosen, and the time frame involved, we strongly recommend that during the interim time period prior to abatement action, control measures be established for the employees and occupants working in the building to minimize their exposure to asbestos.

This program should include, at a minimum, proper safety precautions and cleaning methods by personnel when work must be performed in and around asbestos-containing materials. Also, periodic reassessment of the condition of the asbestos-containing materials should be undertaken and precautions and procedures should be in writing and be thoroughly documented.

4.5 Legal and Medical Considerations

Due to the health hazards and legal ramifications involved in asbestos exposure in public buildings, an interdisciplinary approach between the engineering, medical and legal communities should be involved when determining an asbestos control program. There is presently a tremendous amount of litigation in the courts concerning present and past asbestos exposure in public and private facilities, as well as in the workplace environment.

One basis for much of the litigation stems from the lack of adequate notification by the building owner to building occupants/employees following the identification of asbestos in buildings. As a minimum, building owners should notify building employees, occupants, vendors, and others as required in the OSHA Asbestos Standards (29 CFR 1910.1001 and 29 CFR 1926.1101), and for public facilities, the EPA Worker Protection Rule (40CFR 763, Subpart G). We recommend that you involve appropriate legal counsel in your asbestos control program to address these very important issues.

5.0 LIMITATIONS

AMEC has performed its services in accordance with generally accepted practices at the time of the field work. This report has been prepared on behalf of and exclusively for the use by ***Orange County Risk Management***. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party without AMEC's prior written consent. The findings are relative to the date of our site visit and should not be relied upon for substantially later dates. All material quantities are estimated based on visual observation and should be relied on for contractor bidding or regulatory notification purposes.

Please note that these test results relate only to those homogeneous materials tested. If conditions, or materials, other than those addressed in this report are encountered during the planned maintenance, renovation, or demolition activities, AMEC should be contacted to assess the potential impact of these materials or conditions relative to the findings or recommendations included herein.

APPENDIX A

LABORATORY ANALYSIS

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341409003
CustomerID:	AMECH25
CustomerPO:	C012306785
ProjectID:	Orange County Risk

Attn: **Ron Trapane**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/08/14 8:30 AM
Analysis Date:	10/9/2014
Collected:	9/30/2014

Project: **6380-14-1230.21**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-1A *341409003-0001*	Wall Seams-North Wall - Peach Caulk	Peach Non-Fibrous Homogeneous	2% Cellulose	96% Non-fibrous (other)	2% Chrysotile
B-1B *341409003-0002*	Wall Seams-South Wall - Peach Caulk	Beige Non-Fibrous Homogeneous	2% Cellulose	96% Non-fibrous (other)	2% Chrysotile
B-2A *341409003-0003*	North Wall - CMU & Mortar	Tan Non-Fibrous Heterogeneous		60% Quartz 15% Ca Carbonate 25% Non-fibrous (other)	None Detected
		Inseparable materials. Composite analysis.			
B-2B *341409003-0004*	East Wall - CMU & Mortar	Tan Non-Fibrous Heterogeneous		60% Quartz 15% Ca Carbonate 25% Non-fibrous (other)	None Detected
		Inseparable materials. Composite analysis.			
B-2C *341409003-0005*	West Wall - CMU & Mortar	Beige Non-Fibrous Heterogeneous		45% Quartz 15% Ca Carbonate 40% Non-fibrous (other)	None Detected
		Inseparable materials. Composite analysis.			
B-3A *341409003-0006*	Around Windows - Brown Caulk	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
B-3B *341409003-0007*	Around Windows - Brown Caulk	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
B-4A *341409003-0008*	Interior Wall Joints/Seams - White Caulk	White/Peach Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
		Inseparable paint / coating layer included in analysis			

Initial report from 10/13/2014 08:04:51

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341409003
CustomerID:	AMECH25
CustomerPO:	C012306785
ProjectID:	Orange County Risk

Attn: **Ron Trapane**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/08/14 8:30 AM
Analysis Date:	10/9/2014
Collected:	9/30/2014

Project: **6380-14-1230.21**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-4B *341409003-0009*	Interior Wall Joints/Seams - White Caulk	White/Peach Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
		Inseparable paint / coating layer included in analysis			
B-5A *341409003-0010*	Tank Pad - Gray Coating	Gray Non-Fibrous Homogeneous		20% Quartz 80% Non-fibrous (other)	**None Detected**
B-5B *341409003-0011*	Tank Pad - Gray Coating	White Non-Fibrous Heterogeneous		35% Quartz 65% Non-fibrous (other)	**None Detected**
B-6A *341409003-0012*	Floor - Peach Coating (Granular)	Peach Non-Fibrous Homogeneous		30% Quartz 10% Ca Carbonate 60% Non-fibrous (other)	**None Detected**
B-6B *341409003-0013*	Floor - Peach Coating (Granular)	Peach Non-Fibrous Heterogeneous		30% Quartz 10% Ca Carbonate 60% Non-fibrous (other)	**None Detected**
B-7A *341409003-0014*	Tank Pad - Concrete	Gray Non-Fibrous Heterogeneous		50% Quartz 15% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
B-7B *341409003-0015*	Tank Pad - Concrete	Gray Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
B-8A *341409003-0016*	Slab - Gray Coating	Various Non-Fibrous Heterogeneous		30% Quartz 5% Ca Carbonate 65% Non-fibrous (other)	**None Detected**
		Inseparable paint / coating layer included in analysis			

Initial report from 10/13/2014 08:04:51

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Attn: **Ron Trapane**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/08/14 8:30 AM
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Project: **6380-14-1230.21**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-8B *341409003-0017*	Tank Pad - Gray Coating	Gray/White Non-Fibrous Heterogeneous		40% Quartz 10% Ca Carbonate 50% Non-fibrous (other)	**None Detected**
		Inseparable paint / coating layer included in analysis			
B-9A *341409003-0018*	North-Interior - Stucco	Gray Non-Fibrous Heterogeneous		60% Quartz 15% Ca Carbonate 25% Non-fibrous (other)	**None Detected**
B-9B *341409003-0019*	West-Exterior - Stucco	Gray Non-Fibrous Heterogeneous		60% Quartz 15% Ca Carbonate 25% Non-fibrous (other)	**None Detected**
B-9C *341409003-0020*	East Ext. - Stucco	White Non-Fibrous Heterogeneous		40% Quartz 15% Ca Carbonate 45% Non-fibrous (other)	**None Detected**
		Inseparable paint / coating layer included in analysis			
B-10A *341409003-0021*	Tank-Pad - Concrete	Gray Non-Fibrous Heterogeneous		65% Quartz 5% Ca Carbonate 30% Non-fibrous (other)	**None Detected**
B-10B *341409003-0022*	Bldg Slab - Concrete	Gray Non-Fibrous Heterogeneous		60% Quartz 10% Ca Carbonate 30% Non-fibrous (other)	**None Detected**

Initial report from 10/13/2014 08:04:51

EMSL Analytical, Inc.
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EMSL Order:	341409003
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Attn: **Ron Trapane**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/08/14 8:30 AM
Analysis Date:	10/9/2014
Collected:	9/30/2014

Project: 6380-14-1230.21

The samples in this report were submitted to EMSL for analysis by Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy. The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date::	10/8/2014	Sample Receipt Time:	8:30 AM
Analysis Completed Date:	10/9/2014	Analysis Completed Time:	2:56 PM

Analyst(s):

Jonathan Teda PLM (12)

Manolo Hernandez PLM (10)

Samples reviewed and approved by:

Jonathan Teda, Asbestos Lab Manager
or other approved signatory

Initial report from 10/13/2014 08:04:51

Interoffice Memorandum

Orange County Risk Management
109 East Church Street, Suite 200
Orlando, Florida 32802-1393
Phone: (407) 836-9640 Fax: (407) 836-9630

DATE: Monday, October 13, 2014

TO: Travis Hollman, Engineer II, Utilities Engineering Division

FROM: Joel Howard, Environmental Loss Prevention Analyst
Risk Management Division

SUBJECT: **Report of Limited Pre-Demolition NESHAP Asbestos Survey**
Oak Meadows Water Supply Facility
226 Dorscher Road
Orlando, Orange County, Florida
Parcel ID # 26-22-28-0000-00-004

Risk Management has reviewed and accepted the Limited Pre-Demolition NESHAP Asbestos Survey conducted by AMEC, dated September 9, 2014. The inspection was performed by an accredited inspector according to Federal regulation 49 CFR, Part 763 (AHERA).

Laboratory results indicated that none of the 14 suspect materials sampled contained asbestos fibers. No specialized abatement is required prior to demolition.

Supply the renovation contractor with the enclosed Limited Pre-Demolition NESHAP Asbestos Survey report. Risk Management approves the Limited Pre-Demolition NESHAP Asbestos Survey Report and will retain a copy of the report for future reference.

If you have any questions, please do not hesitate to contact me at (407) 836-9679.

Thank you,

Joel Howard, CIE, RPIH

Enclosure (1)

cc: Tisha Pence, Environmental Loss Prevention Coordinator, Risk Management

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9 September 2014

Mr. Joel Howard
Environmental Loss Prevention Analyst
Orange County Risk Management
109 East Church Street, Suite 200
Orlando, Florida 32802

Phone: +1 (407) 836-9679
Fax: +1 (407) 239-2785
Email: joel.howard@ocfl.net

Subject: **Report of Limited Pre-Demolition NESHAP Asbestos Survey**
Chlorine System in Water Supply Facility for Orange County Utilities
Oak Meadows WSF
226 Dorscher Road
Orlando, Florida 32835
Parcel ID #26-22-28-0000-00-004
AMEC Project 6380-14-1230.21

Dear Mr. Howard,

AMEC Environment & Infrastructure, Inc. (AMEC) has completed the pre-demolition NESHAP asbestos sampling of the Oak Meadows Water Supply Facility (WSF) at 226 Dorscher Road in Orlando, Florida. Specifically, the field survey was limited to pre-selected structures and associated equipment throughout the facility as indicated by OCU engineers. The survey was performed by Mr. Carver Gittens, an AHERA Accredited Inspector from AMEC. The field survey was conducted on 29 September 2014, in accordance with our Proposal 14PROP0010.6380.0430, Revision 1 dated 6 August 2014. The attached report gives a brief background of the project, the procedures used in the field and in laboratory analysis.

AMEC appreciates the opportunity to have been of assistance to you on this project and is looking forward to working with you as your consultant in the future. If you have any questions concerning this report or if we can be of further service, please contact us.

Respectfully,

AMEC Environment & Infrastructure, Inc.
Asbestos Business License No. ZA-0000449

Angel M. Vizcarrondo
Technical Professional

Russell E. Stauffer, P.E.
FL Asbestos Consultant
License No. EA0000016

Appendix A - Laboratory Reports

P:\6380 IEQ\PROJECTS\2014-Projects\1230 - OCRM VIII\1230.21 - OCRM Water Treatment Plants Chlorine Systems\1230.21 OCRM VIII Oak Meadows WSF rpt .doc

Correspondence:
AMEC E&I (local address)
75 East Amelia Street, Suite 200
Orlando, Florida 32801 USA
Tel +1 (407) 522-7570
Fax +1 (407) 522-7576

1.0 PROJECT INFORMATION

Orange County Utilities (OCU) is removing the existing chlorine systems at the above mentioned water supply facility. The pre-demolition NESHAP survey was limited to materials which will be impacted during the removal of the chlorine system. The homogenization of the homogenous areas was based on the size and scope of the chlorine system removal observed by the licensed AHERA Inspector during the survey. Suspect materials included: adhesives, insulation, caulk, louvers, ceiling panels, CMU and mortar, shingles, stucco, eyewash station/shower, and concrete.

Information concerning this project was obtained from a walkthrough conducted on 10 July 2014 with representatives from AMEC (Mr. Angel Vizcarrondo and Mr. Carver Gittens), OCU (Mr. Travis Hollman) and Orange County Risk Management (Mr. Joel Howard). Additional information was obtained from the Orange County Property Appraiser's (OCPA's) website and from demolition drawings and pictures provided by OCU.

According to information obtained from OCPA's website, the structure was constructed in 2002. The interior walls of the structure are constructed of minimum inexpensive materials, while the exterior walls are reinforced concrete, cinder block and stucco.

The NESHAP asbestos survey included bulk sampling of suspect interior and exterior building materials, including when present, roofing products, concrete slabs/foundations/aboveground tank saddles, etc. ***Buried piping or equipment or other areas/structures which were not accessible to AMEC at the time of the site visit were not sampled.*** The structures and equipment are scheduled for demolition. No previous asbestos surveys have reportedly been conducted at the site.

The objective of AMEC's survey was to identify accessible asbestos-containing materials which may be impacted by the planned demolition of pre-selected structures in the Oak Meadows Water Supply Facility.

2.0 SURVEY PROCEDURES

The survey was performed by observing accessible building materials and coatings. Bulk sampling of suspect ACM was limited to accessible building materials, which might be impacted by the planned demolition of pre-selected structures and equipment.

3.0 LIMITED ASBESTOS BULK SAMPLING

3.1 General

The bulk sampling procedures utilized for the collection of suspect materials first required the establishment of a homogeneous sampling area. A homogeneous sampling area is defined as an area of the same type and applied during the same general time period. The individual sampling areas were then examined and representative samples of the suspect materials were obtained. Bulk samples collected during the survey were delivered to EMSL Analytical, Inc., of Orlando, Florida, an NVLAP accredited laboratory (No. 10115-0). The bulk samples were analyzed by Polarized Light microscopy (PLM) coupled with dispersion staining in accordance with EPA Method 600/R-93/116.

Polarized Light Microscopy (PLM) is an analytical method for asbestos identification which depends on the unique optical properties of mineral forms in the samples, and specifically identifies the various asbestos types. This is the referenced method of analysis by EPA for asbestos identification in bulk samples. Materials found to contain greater than one percent asbestos by PLM are Asbestos-Containing Materials (ACM) as defined by EPA, OSHA and the State of Florida.

The EPA National Standard for Hazardous Air Pollutants (NESHAP) Final Rule (40 CFR 61, Subpart M) for asbestos includes an option for verification of friable materials, by point counting, if it is initially determined by PLM analysis that asbestos is present in amounts less than 10 percent. Point Counts were **not** conducted as part of the asbestos NESHAP survey.
The following suspect materials (thought to possibly contain asbestos) were sampled during the survey at the Oak Meadows WSF:

1. Stucco - (Chemical & Analyzer Building North, West & South Exterior Walls)
2. Roof Shingle – (Roof Overhang over Louvers)
3. Caulk Brown - (Chemical & Analyzer Building around Windows)
4. Mastic Beige – (Black 4" Vinyl Cove Base in Walls)
5. Concrete – (Louvers West and South Sections)
6. Concrete Masonry Unit (CMU) and Mortar - (North, East & South Chemical Building Walls)
7. Concrete – (Chemical & Analyzer Building Slab and Tank Pad)
8. Gray Rubberized Coating – (Caustic Tank Insulation)
9. Caulk Beige – (Caustic Tank Building Exterior FRP Seams)

10. FRP Adhesive – (Caustic Storage Tank Building Interior & Exterior Walls)
11. Floor Coating Gray – (Chemical & Analyzer Building Floor)
12. Caulk Gray – (Fluoride Building Exterior Screen)
13. Mastic Yellow (Fluoride and Chemical Buildings Eye Wash Stations Neoprene Seams)
14. Concrete – (Fluoride Building Eye Wash Slab)

3.2 Asbestos Analytical Results

Based upon our visual observations, bulk sampling of ***14*** suspect materials (33 samples and 44 layers) and subsequent PLM microscopic analysis, the previously identified suspect materials were determined **not** to contain regulated amounts of asbestos.

A copy of the asbestos laboratory analysis is included in Appendix A.

3.3 Asbestos Conclusions and Recommendations

Since the pre-selected structures will be demolished, a ten day working day written notification is required prior to the start of demolition activities under the EPA NESHAP regulation (40 CFR 61, Subpart M) and Florida Department of Environmental Protection (FDEP) rules. The subject project is located in ***Orange County*** so notification should be made to the Florida Department of Environmental Protection (FDEP) Central District Office at 3319 Maguire Boulevard, Suite 232, Orlando, Florida 32803-3767, Phone (407) 894-7555, Fax (407) 897-2966, using FDEP Form 62-0257.900(1).

4.0 LIMITATIONS

AMEC has performed its services in accordance with generally accepted practices at the time of the field work. This report has been prepared on behalf of and exclusively for the use by ***Orange County Risk Management and Orange County Utilities Engineering***. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party without AMEC's prior written consent. The findings are relative to the date of our site visit and should not be relied upon for substantially later dates. All material quantities are estimated based on visual observation and should be relied on for contractor bidding or regulatory notification purposes.

Please note that these test results relate only to those homogeneous materials tested. If conditions, or materials, other than those addressed in this report are encountered during the planned maintenance, renovation, or demolition activities, AMEC should be contacted to assess the potential impact of these materials or conditions relative to the findings or recommendations included herein.

APPENDIX A

LABORATORY ANALYSIS

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341408758
CustomerID:	AMECH25
CustomerPO:	C012306785
ProjectID:	Orange County Risk

Attn: **Angel Vizcarrondo**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	10/01/14 5:00 PM
Analysis Date:	10/3/2014
Collected:	9/29/2014

Project: **6380-14-1230.21 Oak Meadows**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-1A *341408758-0001*	West - Stucco	Gray/White Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-1B *341408758-0002*	South - Stucco	Gray/White Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-1C *341408758-0003*	North - Stucco	Gray/White/Beige Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-2A *341408758-0004*	Roof Overhang Over Louvers - Roof Shingle	Various Fibrous Heterogeneous	8% Glass	92% Non-fibrous (other)	**None Detected**
B-2B *341408758-0005*	Roof Overhang Over Louvers - Roof Shingle	Various Fibrous Heterogeneous	8% Glass	92% Non-fibrous (other)	**None Detected**
B-3A *341408758-0006*	Around Window In Separation Wall - Brown Caulk	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-3B *341408758-0007*	Around Window In Separation Wall - Brown Caulk	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-4A-Mastic *341408758-0008*	NW Sect - Beige Mastic Under Black 4" Cove Base	Gray/Beige Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B-4A-Cove Base *341408758-0008A*	NW Sect - Beige Mastic Under Black 4" Cove Base	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-4B-Mastic *341408758-0009*	South Wall - Beige Mastic Under Black 4" Cove Base	Gray/Beige Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
B-4B-Cove Base *341408758-0009A*	South Wall - Beige Mastic Under Black 4" Cove Base	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-5A *341408758-0010*	West Sect - Concrete	White/Beige Non-Fibrous Heterogeneous		45% Quartz 10% Ca Carbonate 45% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-5B *341408758-0011*	South Sect - Concrete	White/Beige Non-Fibrous Heterogeneous		45% Quartz 10% Ca Carbonate 45% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-6A *341408758-0012*	South Wall - CMU & Mortar	Gray/White Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
			Inseparable materials, composite analysis.		
B-6B *341408758-0013*	West Wall - CMU & Mortar	Gray/White Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable materials, composite analysis.		

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-6C *341408758-0014*	North Wall - CMU & Mortar	Gray/White Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable materials, composite analysis.		
B-7A *341408758-0015*	Slab - Concrete	Gray/Tan/White Non-Fibrous Heterogeneous		55% Quartz 10% Ca Carbonate 35% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-7B *341408758-0016*	Pad - Concrete	Gray/White Non-Fibrous Heterogeneous		50% Quartz 10% Ca Carbonate 40% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-8A-Coating *341408758-0017*	Insulation - Gray Rubberized Coating	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-8A-Insulation *341408758-0017A*	Insulation - Gray Rubberized Coating	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-8B-Coating *341408758-0018*	Insulation - Gray Rubberized Coating	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-8B-Insulation *341408758-0018A*	Insulation - Gray Rubberized Coating	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-8C-Coating *341408758-0019*	Insulation - Gray Rubberized Coating	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

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Project: **6380-14-1230.21 Oak Meadows**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-8C-Insulation *341408758-0019A*	Insulation - Gray Rubberized Coating	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-9A-Caulk *341408758-0020*	Exterior Seams Of FRP - Beige Caulk	Beige Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-9A-Insulation *341408758-0020A*	Exterior Seams Of FRP - Beige Caulk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-9B-Caulk *341408758-0021*	Exterior Seams Of FRP - Beige Caulk	Beige Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-9B-Insulation *341408758-0021A*	Exterior Seams Of FRP - Beige Caulk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-10A *341408758-0022*	Interior Walls - FRP & Adhesive	Tan/White Fibrous Heterogeneous	30% Glass No adhesive present.	70% Non-fibrous (other)	**None Detected**
B-10B *341408758-0023*	Interior Walls - FRP & Adhesive	Tan/White Fibrous Heterogeneous	30% Glass No adhesive present.	70% Non-fibrous (other)	**None Detected**
B-10C *341408758-0024*	Exterior Wall - FRP & Adhesive	Tan/White Fibrous Heterogeneous	25% Glass No adhesive present.	75% Non-fibrous (other)	**None Detected**
B-11A *341408758-0025*	Floor - Gray Floor Coating	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

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			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
B-11B *341408758-0026*	Floor - Gray Floor Coating	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-11C *341408758-0027*	Floor - Gray Floor Coating	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-12A *341408758-0028*	Exterior Caulk Around Screen - Gray Caulk	Gray/White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-12B *341408758-0029*	Exterior Caulk Around Screen - Gray Caulk	Gray/White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
			Inseparable paint / coating layer included in analysis		
B-13A-Yellow Mastic *341408758-0030*	Eye Wash Station - Yellow Mastic On Neoprene Seams	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-13A-Insulation *341408758-0030A*	Eye Wash Station - Yellow Mastic On Neoprene Seams	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-13A-Tan Mastic *341408758-0030B*	Eye Wash Station - Yellow Mastic On Neoprene Seams	Tan Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-13B-Yellow Mastic *341408758-0031*	Eye Wash Station - Yellow Mastic On Neoprene Seams	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B-13B-Insulation *341408758-0031A*	Eye Wash Station - Yellow Mastic On Neoprene Seams	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-13B-Tan Mastic *341408758-0031B*	Eye Wash Station - Yellow Mastic On Neoprene Seams	Tan Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
B-14A *341408758-0032*	Eye Wash Slab - Concrete	Gray/White Non-Fibrous Heterogeneous	<1% Glass	45% Quartz 10% Ca Carbonate 45% Non-fibrous (other)	**None Detected**
B-14B *341408758-0033*	Eye Wash Slab - Concrete	Gray/White Non-Fibrous Heterogeneous		45% Quartz 15% Ca Carbonate 40% Non-fibrous (other)	**None Detected**

Inseparable paint / coating layer included in analysis

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Received:	10/01/14 5:00 PM
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Project: **6380-14-1230.21 Oak Meadows**

The samples in this report were submitted to EMSL for analysis by Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy. The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date::	10/1/2014	Sample Receipt Time:	5:00 PM
Analysis Completed Date:	10/3/2014	Analysis Completed Time:	3:50 PM

Analyst(s):

Katelyn Wright PLM (19)

Manolo Hernandez PLM (25)

Samples reviewed and approved by:

Jonathan Teda, Asbestos Lab Manager
or other approved signatory

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SODIUM HYPCHLORITE

SPECIFICATIONS

PROPERTIES

Sodium hypochlorite supplied under this contract shall be tested and certified as meeting these specifications and those of the American National Standards Institute/National Sanitation Foundation Standard 60 (ANSI/NSF Standard 60), drinking water treatment chemicals health effects.

Sodium hypochlorite (12.5 Trade Percent Available Chlorine) supplied shall be in accordance with the American Water Works Association's (AWWA's) Standard B-300-04 for hypochlorite. Upon request, the Contractor shall supply the County with a written chemical analysis of any shipment.

TYPICAL PRODUCT CHARACTERISTICS

Chemical Analysis, typical

Sodium hypochlorite supplied under this contract shall have a minimum of 125 grams per liter available chlorine equivalent to 12.5 percent sodium hypochlorite by weight.

Containment concentration limits

Iron	< 0.3 mg/L
Copper	< 0.03 mg/L
Nickel	< 0.03 mg/L
Chlorate	< 2,500 mg/L
Bromate	≤ 20 mg/L

The suspended solids in the sodium hypochlorite supplied under this contract shall be minimized and shall achieve a filtration time of less than 3 minutes for 1000 ml when applying the *"Suspended Solids Quality Test for Bleach Using the Vacuum Filtration"* Method co-developed by Dr. Bernard Bubnis of NovaChem

Chemical Certification Report

A certified report from the manufacturer shall be submitted for all sodium hypochlorite deliveries to Orange County during this contract. The report shall contain the following data:

- Date and Time of Manufacture
- Percent by Weight Sodium Hypochlorite
- Percent by Weight Excess Sodium Hydroxide
- Specific Gravity (Referenced to a temperature)
- Suspended Solids Test Time

HYDROFLUOSILICIC ACID

SPECIFICATIONS

PROPERTIES

The Hydrofluosilicic Acid shall meet State of Florida Department of Environmental Protection and Department of Health requirements for potable water treatment chemicals, and ANSI/NSF Standard 60. Additionally the requirements of AWWA Standard B703-00 for Hydrofluosilicic Acid must be met in all areas not in conflict with ANSI 60. This material shall be certified as suitable for contact with or treatment of drinking water by an accredited certification organization in accordance with ANSI/NSF Standard 60, Drinking Water Treatment Chemicals-Health Effects. A copy of an analysis from a certified laboratory must accompany the first shipment of product supplied for this contract. The analysis shall be retained by Orange County Utilities (OCU) as a public document.

TYPICAL PRODUCT CHARACTERISTICS

Chemical Analysis, typical

Assay (H_2SiF_6)	23.00 % Minimum / 25% Maximum
Fluorine (F)	18.22 % Minimum
Heavy Metals, as Lead (Pb)	00.02 % Maximum
Hydrofluoric Acid (HF)	Less than 1.00 %

Physical Properties

Description	Water white to straw yellow solution, meeting both the
	AWWA Standard B703-00 and the ANSI/NSF Standard 60.
Color	Straw yellow shall be determined as material with a
	maximum of 100 units (APHA) in accordance with method
	2120B, visual comparison method.
Specific Gravity	1.234 (H_20 for 25%) @ 60° F
Boiling Point for 25%	222.5° F
Freezing Point for 25%	4° F (-15.5° C)
Molecular Weight	144.08
Weight per Gallon for 25%	10.29 lbs / gal
Viscosity for 23%	6.5 cps

Freight Description

DOT Shipping Classification	Class 8 (Corrosive)
DOT Shipping Name	Fluorosilicic Acid
Packing Group II	Placard: Corrosive
DOT/UN Number	1778

Attachment B
Forms

APPENDIX B **FORMS**

Pressure Test February 11, 2011

Project Name: _____

Constructed by: _____

☐ **Force Main**
☐ **Reclaimed Main**
☐ **Water Main**

Allowable Loss – 2 Hours
L = SD (P) 1/2
148,000 ***See Note Below***

DATE	LINE SEGMENT	STATION		LENGTH	N	D	START		END		LOSS (gal)		Pass /Fail STATUS
		From	To				Time	PSI	Time	PSI	Allow	Actual	

COUNTY Inspector's Name:		**Signature:**		**Date:**
Tester's Name:		**Signature:**		**Date:**

Comments:

Note: L - Allowable leakage in gallons per hour.
S - Length of pipe tested, in feet.
D - Nominal diameter of the pipe in inches.
P - Average test pressure during leakage test in pounds per square inch gauge.

APPENDIX B FORMS

Water Main Disinfection Certification

February 11, 2011

This form is required to schedule and document the disinfection of newly installed water mains to AWWA C-651 – latest revision. The CONTRACTOR shall complete the top portion of this form to document the subject water main, disinfection method and amount of chlorine applied. The UTILITIES inspector will document the residuals at each sample point on the bottom portion of this form.

Date Requested: _____

CONTRACTOR's Name: _____

Project Name: _____

Project Number: _____

Location: _____ Plan Sheet No.(s): _____

Starting Location: _____ Ending Location: _____

Line Length: _____ Line Size: _____

Pipe Material: _____ Type of Joint(s): _____

Gallons to Fill Pipe: _____ Pounds of Chlorine Applied: _____

Method of Disinfection Used: _____

CONTRACTOR's Signature: _____ Date: _____

For COUNTY Use Only

Certification Information

Start Time: _____ *Start PSI:* _____

Stop Time: _____ *Stop PSI:* _____

Sample Point Number	*Sample Point Location*	*Initial Chlorine Reading, Minimum 25 ppm Required*	*24 Hr Chlorine Reading, Minimum 10 ppm Required*

Lab Test Results

Passed: _____ *Failed:* _____ *Incomplete:* _____

Comments:

_____

_____

Inspector's Signature: _____ Date: _____

O.C. WSF CHEMICAL SYSTEMS IMPROVMENTS
CONTRACTOR'S ASSISTANCE REQUEST
FOR ACCESS TO COUNTY FACILITIES

DATE: _____ **NUMBER:** _____

LOCATION/STRUCTURE:

_____

PURPOSE:

_____

_____

ADDITIONAL ASSISTANCE REQUESTED:

_____

_____

_____

DATE ACCESS NEEDED: _____

DURATION OF WORK: _____

_____ _____

Contractor **O.C.U. Construction**

COMMENTS/RESTRICTIONS:

_____

_____

_____

_____

_____

_____

PLANT SUPERVISOR

Attachment C
Permits by Owner

Florida Department of Environmental Protection
Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

RICK SCOTT
GOVERNOR

CARLOS LOPEZ-CANTERA
LT. GOVERNOR

CLIFFORD D. WILSON III
INTERIM SECRETARY

December 18, 2014

ELECTRONIC CORRESPONDENCE

In the matter of an
Application for Permit by:

Orange County Utilities
Christine Doan, P.E., Chief Engineer
9150 Curry Ford Road
Orlando, FL 32825
Christine.Doan@ocfl.net

DEP File No. 0124922-579-WC
County: Orange

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number 0124922-579-WC for the replacement and upgrading of Chemical Feed (Sodium Hypochlorite and Fluoride) Systems to the Orangewood Water Supply Facility, issued pursuant to Section 403.861(9), Florida Statutes.

This permit is final and effective on the date filed with the clerk of the Department unless a petition is filed in accordance with the paragraphs below or unless a request for extension of time in which to file a petition is filed within the required timeframe and conforms to Rule 62-110.106(4), F.A.C. Upon timely filing of a petition or a request for an extension, this permit will not be effective until further Order of the Department.

A person whose substantial interests are affected by this permit may petition for an administrative proceeding (hearing) in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) with the Agency Clerk for the Department of Environmental Protection, Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, within 14 days of receipt of this Notice. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-106.205, F.A.C.

A petition must contain the following information:
(a) The name and address of each agency affected and each agency's file or identification number, if known;
(b) The name, address, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;

(c) A statement of how and when the petitioner received notice of the agency decision;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A concise statement of the ultimate facts alleged, including the specific facts which petitioner contends warrant reversal or modification of the Department's action;
(f) A statement of the specific rules or statutes the petitioner contends requires reversal or modification of the Department's action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
(g) A statement of the relief sought by petitioner, stating precisely the action that the petitioner wants the Department to take.

A petition that does not dispute the materials facts on which the Department's action is based shall state that no such facts are in dispute and otherwise contain the same information as set forth above, as required by Rule 28-106.301, F.A.C.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that, the Department's final action may be different from the position taken by it in this Notice. Persons whose substantial interests will be affected by any such final decision of the Department on the petition have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

When the Order (Permit) is final, any party to the Order has the right to seek judicial review of the Order pursuant to section 120.68 of the Florida Statutes, by filing a Notice of Appeal pursuant to Rule 9.110 of the Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000; and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when the final order is filed with the Clerk of the Department.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Christianne C. Ferraro, P.E.
Administrator, Water Permitting Program

Enclosures: Permit No. 0124922-579 –WC

FILING AND ACKNOWLEDGEMENT/ CERTIFICATION OF SERVICE

FILED, on this date, under Section 120.52(7), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged. The undersigned hereby acknowledges that this **Notice of Permit Issuance** and all copies were electronically transmitted before the close of business on December 18, 2014 to those persons listed by.

Clerk

December 18, 2014
Date

Copies Furnished to:

Daniel Allen, P.E., BFA Environmental Consultants [dallen@bfaenvironmental.com]
FDEP: Caroline Shine, Jill Farris, Nathan Hess, Richard Lott

Florida Department of Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

RICK SCOTT
GOVERNOR

CARLOS LOPEZ-CANTERA
LT. GOVERNOR

CLIFFORD D. WILSON III
INTERIM SECRETARY

December 18, 2014

ELECTRONIC CORRESPONDENCE

PERMITTEE:
Orange County Utilities
Christine Doan, P.E., Chief Engineer
9150 Curry Ford Road
Orlando, FL 32825
Christine.Doan@ocfl.net

PWS ID NUMBER: 3484119
PERMIT NUMBER: 0124922-579-WC
DATE OF ISSUE: December 18, 2014
EXPIRATION DATE: December 17, 2019
COUNTY: Orange
PROJECT: Orangewood WSF Chemical Feed System Replacement Project
PWS Type: Community

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (F.A.C.) Chapters 62-4, 62-550, 62-555 and 62-560. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

TO CONSTRUCT: replacement and upgrading of the Chemical Feed (Sodium Hypochlorite and Fluoride) System at the Orangewood Water Supply Facility (WSF). The facility is fully monitored and controlled through the County's SCADA system.

PROPOSED CONSTRUCTION INCLUDES THE FOLLOWING (OR THEIR EQUIVALENTS):

- Chlorination System including the following components:
  - Two (2) 4,400 gallon double wall polyethylene bulk storage tanks with sight gauge (123-inch diameter, 123 inches high);
  - Two (2) diaphragm positive displacement metering pump skids (pre- and post-chlorination) with a capacity from 14.8 to 35.4 gallons per hour (gph);
  - Emergency eyewash and shower.

- Fluoride System including the following components:
  - One (1) 30 gallon double wall high density cross-linked polyethylene day storage tank with (53-inch diameter, 60 inches high);
  - One (1) 360 gallon single wall high density cross-linked polyethylene bulk storage tank with sight gauge (23-inch diameter, 23 inches high);
  - Two (2) diaphragm positive displacement metering pumps with a capacity from 0.4 to 0.9 gph;
  - Emergency eyewash and shower.

Chemical tanks will be vented to the atmosphere to prevent a vacuum inside the tank during draining or pressurizing during filling. Outside, the vent shall be equipped with an insect screen. There is an exhaust fan in the chlorination room. The fluoridation room has a screen enclosure on two sides with adequate ventilation.

Chemical scales for each day tank will be of the digital readout/electronic single load cell type. Tanks will also have a leak detection system with sensors mounted in the interstitial space between the inner and outer walls. Each liquid storage tank is protected against cross-connections.

Both feed systems shall include the following: fabricated skids with containment and leak detection, calibration chambers, pressure relief valves, pulsation dampeners with integral pressure gauges, backpressure valves, isolation valves, input and output signals and alarms, and pressure gauges.

There is a standby chlorination treatment unit or combination of treatment units of sufficient size to meet capacity to replace the largest unit when out of service.

IN ACCORDANCE WITH: documents submitted on November 20, December 5 and 17, 2014

LOCATION: 5707 Sea Harbor Drive in Orlando, Florida

Work must be conducted in accordance with the General and Specific Conditions, attached hereto.

The permittee shall be aware of and operate under the Permit Conditions below. These applicable conditions are binding upon the permittee and enforceable pursuant to Chapter 403, Florida Statutes. [F.A.C. Rule 62-555.533(1)]

A. GENERAL CONDITIONS

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, F.S. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times (reasonable time may depend on the nature of the concern being investigated), access to the premises where the permitted activity is located or conducted to:
   a. Have access to and copy any records that must be kept under conditions of the permit;
   b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and
   c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:
   a. A description of and cause of noncompliance; and
   b. The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to

enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard.

11. This permit is transferable only upon Department approval in accordance with Rule 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:
    a. Determination of Best Available Control Technology (BACT)
    b. Determination of Prevention of Significant Deterioration (PSD)
    c. Certification of compliance with State Water Quality Standards (Section 401, PL 92-500)
    d. Compliance with New Source Performance Standards

14. The permittee shall comply with the following:
    a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

    b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:
   i. the date, exact place, and time of sampling or measurements;
   ii. the person responsible for performing the sampling or measurements;
   iii. the dates analyses were performed;
   iv. the person responsible for performing the analyses;
   v. the analytical techniques or methods used;
   vi. the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS

B. Construction Activities

1. Permit Modification

All construction must be in accordance with this permit. Before commencing work on project changes for which a construction permit modification is required per 62-555.536(1), the permittee shall submit to the Department a written request for a permit modification. Each such request shall be accompanied by one copy of a revised construction permit application, the proper processing fee and one copy of either a revised preliminary design report or revised drawings, specifications and design data. [F.A.C. Rule 62-555.536].

2. Professional Engineer Supervision

Permitted construction or alteration of public water supply systems must be supervised during construction by a professional engineer registered in the State of Florida if the project was designed under the responsible charge of a professional engineer licensed in the State of Florida. The permittee must retain the service of a professional engineer registered in the State of Florida to observe that construction of the project is in accordance with the engineering plans and specifications as submitted in support of the application for this permit. [F.A.C. Rule 62-555.520(3)].

3. Artifacts

If prehistoric or historic artifacts, such as pottery or ceramics, stone tools or metal implements, dugout canoe remains, or any other physical remains that could be associated with Native American cultures, or early colonial or American settlement are encountered at any time within the project site area, the permitted project should cease all activities

involving subsurface disturbance in the immediate vicinity of such discoveries. The permittee, or other designee, should contact the Florida Department of State, Division of Historical Resources, Compliance and Review Section at 850.245.6333 or 800.847.7278, as well as the appropriate permitting agency office. Project activities should not resume without verbal and/or written authorization from the Division of Historical Resources and the permitting agency. In the event that unmarked human remains are encountered during permitted activities, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, *Florida Statutes*.

4. Delays and Extension of Permit

If delays will cause project completion to extend beyond the expiration date of this permit, the permittee shall submit to the Department a request to extend the expiration date of this permit including the appropriate processing fee. This request shall specify the reasons for the delay and shall be submitted to the Department for approval prior to the expiration date of this permit. Note that no specific construction permit shall be extended so as to remain in effect longer than five years. [F.A.C. Rule 62-555.536(4)].

5. Permit Transfer

In accordance with General Condition #11 of this permit, this permit is transferable only upon Department approval. Persons proposing to transfer this permit must apply jointly for a transfer of the permit within 30 days after the sale or legal transfer of ownership of the permitted project that has not been cleared for service by the Department using form, 62-555.900(8), Application for Transfer of a PWS Construction Permit along with the appropriate fee. [F.A.C. Rule 62-555.536(5)]

6. Obligation to Obtain Other Permits

This permit satisfies Drinking Water permitting requirements only and does not authorize construction or operation of this facility prior to obtaining all other necessary permits from other program areas within the Department, or required permits from other state, federal, or local agencies.

7. Limits on Authorizing Connections

This permit is for CONSTRUCTION ONLY of the components found on page 1 of this permit. This permit shall not infer that the clearance necessary for connection will be granted. Partial clearance may be granted, if required.

8. Gasoline Contamination

If gasoline contamination is found at the construction site, work shall be stopped and the proper authorities notified. With the approval of the Department, ductile iron pipe and fittings, and solvent resistant gaskets materials shall be used in the contaminated area. The ductile pipe shall be used in the contaminated area. The ductile iron pipe shall extend 100 feet beyond any solvent noted. Any contaminated soil that is excavated shall be placed on an impermeable mat, covered with waterproof covering, and held for disposal. If the site

cannot be properly cleaned, then consultation with the Department is necessary prior to continuing with the project construction.

9. Wetlands Jurisdiction

This permit does not constitute approval of construction on jurisdictional wetland areas; therefore such approval must be obtained separately from the Water Management District or from the DEP Environmental Resource Permitting (ERP Section), as applicable. Permittee shall provide a copy of the permit approval to the Department when water main installation involves activities on wetlands.

10. Security

Permittee shall ensure that the well and drinking water treatment facilities will be protected to prevent tampering, vandalism, and sabotage as required by Rule 62-555.315(1) & 62-555.320(5), F.A.C.

C. Construction Standards

1. National Sanitation Foundation (NSF)

All products, including paints, which shall come into contact with potable water, either directly or indirectly, shall conform with National Sanitation Foundation (NSF) International, Water Chemicals Codex, Food Chemicals Codex, American Water Works Association (AWWA) Standards and the Food and Drug Administration, as provided in Rule 62-555.320(3), F.A.C.

2. American Water Works Association (AWWA)

Water supply facilities, including mains, pipe, fittings, valves, fire hydrants and other materials shall be installed in accordance with the latest applicable AWWA Standards and Department rules and regulations. The system shall be pressure and leak tested in accordance with AWWA Standard C600 C603, or C605, as applicable, and disinfected in accordance with AWWA Standard C651-653, as well as in accordance with Rule 62-555.340, F.A.C.

3. Lead Free

The installation or repairs of any public water system, or any plumbing in residential or nonresidential facilities providing water for human consumption, which is connected to a public water system shall be lead free in accordance with Rule 62-555.322, F.A.C.

4. Asbestos

If any existing asbestos cement (AC) pipes will be replaced under this permit, the permittee shall do so in accordance with the applicable rules of Federal Asbestos Regulation and Florida DEP requirements. For specific requirements applicable to AC pipes, **the permittee should contact Mary Lawrence prior to commencing any such activities at (407) 897-4179.** Please be aware that a notification is required to be submitted to the Department for a regulated project.

5. Hazard and Reuse Setbacks

Setback distances between potable water wells and sanitary hazards shall be in accordance with 62-555.312, F.A.C. Reclaimed water land application areas, if applicable, must not be located within the setback distance from potable water supply wells established in Chapter 62-610, F.A.C.

6. Line Separation

Permittee shall maintain vertical clearance and horizontal separation between water mains and sanitary sewers, storm sewers, etc. unless approved otherwise by the Department, as provided in Rule 62-555.314, F.A.C., and Section 8.6 of *Recommended Standards for Water Works*, a manual adopted by reference in Rule 62-555.330(3), F.A.C.

7. Color Coding of Pipes

The new or altered aboveground piping at the drinking water treatment plant shall be color coded and labeled as recommended in Section 2.14 of "Recommended Standards for Water Works, 1997 Edition." [F.A.C. Rule 62-555.320(10)]

8. Cross Connections

Permittee shall ensure that there shall be no cross-connection with any non-potable water source in accordance with Rule 62-555.360, F.A.C.

D. Operational Requirements

1. Staffing

The facility has been classified as a Category xx, Class X water treatment plant and does not change as the result of this permit.

2. Operation and Maintenance to comply with Water Quality Standards

The supplier of water shall operate and maintain the public water system so as to comply with applicable standards in F.A.C. Rule 62-550 and 62-555.350.

3. Operation and Maintenance Manual

The permittee shall provide an operation and maintenance manual for the new or altered treatment facilities to fulfill the requirements under subsection 62-555.350(13), F.A.C. The manual shall contain operation and control procedures, and preventative maintenance and repair procedures, for all plant equipment and shall be made available for reference at the plant or at a convenient location near the plant. Bound and indexed equipment manufacturer manuals shall be considered sufficient to meet the requirements of the subsection.

4. Monthly Operating Reports (MORs)

The permittee shall submit monthly operation reports (MORs) DEP Form 62-555.900(3) for the groundwater treatment, to the Department, no later than the tenth of each succeeding month. Systems with multiple treatment plants must also submit DEP Form 62-555.900(11) entitled "Monthly Operation Report for Summation of Finished-Water Production by CWSs That Have Multiple Treatment Plants."

5. Record Drawings

The permittee shall have complete record drawings produced for the project in accordance with Rule 62-555.530(4), F.A.C.

6. State Watch Office

The permittee or suppliers of water shall telephone the State Watch Office (SWO), at 1-800-320-0519 immediately (i.e., within two hours) after discovery of any actual or

suspected sabotage or security breach, or any suspicious incident, involving a public water system in accordance with the F.A.C. Rule 62-555.350(10).

E. Monitoring Provisions

1. Compliance Monitoring by System Type

Permittee shall follow the guidelines of Chapters 62-550, 62-555, and 62-560, F.A.C., regarding public drinking water system standards, monitoring, reporting, permitting, construction, and operation.

This facility is a Community Water System as defined in F.A.C. Rule 62-550.200(12) and shall comply with the applicable chemical, radiological, lead and copper, and bacteriological monitoring requirements of F.A.C. Rule 62-550. Such requirements shall be initiated within the quarter that the water treatment facility is placed into service (i.e. January—March or April—June, the preceding are examples of quarters) and the results submitted to the Department.

2. Chlorine Residual

The Water Treatment Plant shall maintain throughout the distribution system, a minimum continuous and effective free chlorine residual of 0.2 mg/L (or its equivalent. A minimum system pressure of 20 psi must be maintained throughout the system. Also, safety equipment shall be provided and located outside of chlorine room.

F. Clearance Requirements

1. Clearance Letter

The permittee must instruct the engineer of record to request system clearance from the Department within sixty (60) days of completion of construction, testing and disinfecting the system. Bacteriological test results shall be considered unacceptable if the test were completed more than 60 days before the Department received the results. [F.A.C. Rule 62-555.340(2)(c)]

Permitted construction or alteration of a public water system may not be placed into service until a letter of clearance has been issued by this Department. [F.A.C. Rule 62-555.345]

2. Requirements to Obtain Clearance

Prior to submitting the permit clearance package, the permittee will contact Javed Mayet at 407.897.4128 or Javed.Mayet@dep.state.fl.us to establish a date/time for an inspection of the components contained in this permit.

a. the engineer's *Certification of Construction Completion and Request for Clearance to Place Permitted PWS Components Into Operation* {DEP Form 62-555.900(9)};

b. certified record drawings, if there are any changes noted for the permitted project.

c. copy of a satisfactory pressure test of the process piping performed in accordance with AWWA Standards. [F.A.C. Rule 62-555.320(21)(a)(1)]

d. analytical results from two consecutive days of satisfactory bacteriological samples from locations found in paragraph 3 below.

3. Cleaning, Disinfecting, and Bacteriological Samples

The new facilities shall be cleaned, disinfected, and bacteriologically cleared in accordance with Chapter 62-555, F.A.C. The bacteriological clearance data shall be submitted to the Department with the engineer's certification of construction completion. [Section 62-555.340 and 62-555.315(6)(b), F.A.C.]

Bacteriological Sampling Locations: Copies of results from satisfactory bacteriological samples shall be submitted with the clearance package. Samples shall be taken from the point of entry to the water distribution system, in accordance with Rules 62-555.315 (6), 62-555.340 and 62-555.330, F.A.C. and American Water Works Association (AWWA) Standard C 651-92.

Each location shall be sampled on two separate days (at least 6 hours apart) with sample point locations and chlorine residual readings **clearly indicated** on the report and/or drawings.

Bacteriological sample results will be considered unacceptable if the tests were completed more than 60 days before the Department receives the results.

In order to facilitate the issuance of a letter of clearance, the Department requests that all of the above information be submitted as one package.

The entire clearance document package can be submitted in Portable Document Format (pdf) to DEP_CD@dep.state.fl.us, with a copy to Richard Lott at Richard.Lott@dep.state.fl.us for faster processing. Any submitted drawings [standard 11″ x 17″] and the engineer of record's seal on the required document must be legible for acceptance.

DEP forms can be found at the Department website .

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Christianne C. Ferraro, P.E.
Administrator, Water Permitting Program

Erin Giblin

From: Dan Allen
Sent: Monday, February 17, 2014 9:27 AM
To: Travis.Hollman@ocfl.net
Cc: KIM.KUNIHIRO@ocfl.net; Rick WIlson; Erin Giblin
Subject: FW: Orange County Utilities WSF Chemical Feeds System Replacement Project - Request For Permit Determination

Travis,

Below is the email Permit Determination from Richard Lott at FDEP. Please start the process for the $1,000 permit for the chemical system improvements at the Orangewood WSF. Please let me know if you have any questions.

Daniel

Daniel L. Allen, PE
Senior Vice President
BFA Environmental Consultants
1230 Hillcrest Street
Orlando, Fl 32803
Ph.: 407-896-8608
Email: dallen@bfaenvironmental.com

From: Lott, Richard [mailto:Richard.Lott@dep.state.fl.us]
Sent: Wednesday, February 12, 2014 9:10 AM
To: Rick WIlson
Cc: Dan Allen; Cardona, Manuel; Shine, Caroline
Subject: RE: Orange County Utilities WSF Chemical Feeds System Replacement Project - Request For Permit Determination

Rick:
Thank you for clearly defining the proposed changes to the Cypress Walk (OCUD-Southern), Orangewood(OCUD-Southern), Hunter's Creek(OCUD-Southern), and Oak Meadows (OCUD-?) water treatment plants.

Pursuant to Rule 62-555.520(1)(c)1, F.A.C., the Department is willing to regard the proposed changes to sodium hypochlorite (bulk storage tanks and chemical feed system -skids and pumps), and fluoride feed system (day tank and chemical feed system) for the Cypress Walk, Hunter's Creek, and Oak Meadows WTPs as like-for-like replacements and not require a permit. However, the Department requests that the manufacturers' and equipment specification sheets and dosing calculations for these components be submitted so that our records may be updated.

Changes to the Orangewood WTP do not appear to meet the criteria previously mentioned and so would require a minor modification to the system for all of the proposed changes. The Fee

will be $1000 and should be submitted using Form 62-555.900(1), F.A.C. along with the appropriate manufacturers' and equipment specification sheets and dosing calculations.

If you have any questions, please contact me at 407.897.4122.

Richard Lott, P.G., P.E.
FDEP Central District

From: Rick WIlson [mailto:rick@epicgroupllc.com]
Sent: Thursday, December 19, 2013 10:33 AM
To: Lott, Richard
Cc: 'Dan Allen'
Subject: Orange County Utilities WSF Chemical Feeds System Replacement Project - Request For Permit Determination

Richard,

As we discussed a few weeks ago, I am working with BFA on a project for Orange County Utilities (OCU). The project involves replacing Sodium Hypochlorite and Fluoride chemical systems at the following OCU WSFs.

- Cypress Walk
- Orangewood
- Hunters Creek
- Oak Meadows

The improvements were necessary to address the age of the equipment, to improve operation and to adjust some equipment to more closely match actual operating requirements. Since the project is essentially a replacement of equipment (with some adjustments based on actual operating experience), we believe that a permit may not be necessary for this project; consequently, we are requesting a permit determination.

The number of tanks and pumps, and the system operation will remain the same; however, some tank volumes and pump sizes have been adjusted to match actual operating requirements and commercially available equipment from the approved manufacturers. To facilitate your permit determination (and as we discussed), I have prepared a summary table for the systems to show existing equipment and proposed equipment. The tables are presented below and attached as a PDF document.

<u>There is no change in WSF permitted or treatment capacity proposed with this project.</u>

A comparison of the existing and proposed systems is summarized as follows:

<u>Sodium Hypochlorite Storage and Feed Systems</u>

- The number of tanks and pumps will remain the same.
- The volumes of the bulk storage tanks are essentially the same, with slight changes based on commercially available volumes from the approved manufacturers for double walled containment tanks.
- The pump operating range at three WSFs has been adjusted based on actual operating experience over the past 10 years.

<u>Fluoride Storage and Feed Systems</u>

- The number of tanks and pumps will remain the same.

- The proposed bulk tanks will now provide double walled containment. The storage volumes have been adjusted to match actual chemical usage and commercially available tank volumes from the approved tank manufacturers (for double walled containment tanks).
- The day tanks are essentially the same volume.
- The pump operating range at three WSFs has been adjusted slightly based on actual operating experience over the past 10 years.

We look forward to your reply. If you have any questions, please contact me at 407-721-6954 or Dan Allen at 407 896-8608.

Thanks,

Rick Wilson, P.E.

OCU Sodium Hypochlorite Feed System Improvements - Comparison of Existing to Proposed

Item	Cypress Walk	Orangewood	Hunter's Creek	Oak Meadows
Bulk Storage Tanks				
Number				
Existing	2	2	2	2
Proposed	2	2	2	2
Total Volume, gal				
Existing	2,200	10,200	5,000	6,000
Proposed	2,200	8,800	5,000	6,300
Chemical Feed System (skids and pumps)				
Number of Skids				
Existing	2	2	2	2
Proposed	2	2	2	2
Pumps per skid				
Existing	2	2	2	2
Proposed	2	2	2	2
2011/2012 Average Feed Rate	1.5	15.6	9.0	5.5
Maximum Pump Capacity , gph (Note1)				
Existing	34.3	96.5	34.3	69.7
Proposed	11.1	69.7	34.3	34.3

1. Based on Prominent pumps which are currently installed.

OCU Fluoride Feed System Improvements - Comparison of Existing to Proposed

Item	Cypress Walk	Orangewood	Hunter's Creek	Oak Meadows
Bulk Storage Tanks				
Number				
Existing	1	1	1	1
Proposed	1	1	1	1
Total Volume, gal				

Existing	550	1,500	550	1,100
Proposed	275	360	360	500
Days of Storage with Proposed Volume, days	44	32	37	57
Day Tank				
Number				
Existing	1	1	1	1
Proposed	1	1	1	1
Total Volume, gal				
Existing	30	50	50	30
Proposed	30	30	30	30
Chemical Feed System (skids and pumps)				
Number of Skids				
Existing	1	1	1	1
Proposed	1	1	1	1
Pumps per skid				
Existing	2	2	2	2
Proposed	2	2	2	2
2011/2012 Average Feed Rate	0.2	0.3	0.4	0.2
Maximum Pump Capacity , gph (Note1)				
Existing	1.1	2.9	2.9	1.9
Proposed	1.1	1.9	1.9	1.1

1. Based on Prominent pumps which are currently installed.

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Attachment D
List of Approved Products

APPENDIX D **LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Air Release	ARV Enclosure	**All ARV above ground enclosures shall be vented with tamper proof locking device**						
		Water Plus Polyethylene Enclosure	131632 H30-B	Blue 44" Tall	131632 H30-P	Pantone 44"	131632 H30-G	Green 44" Tall
			171730 H40-B	Blue 30" Tall	171730 H40-P	Pantone 30"	171730 H40-G	Green 30" Tall
		Hot Box Vent Guard Fiberglass Enclosure	AVG2036 Encl GP3232 Base	Blue 36" Tall	AVG2036 Encl GP3232 Base	Pantone 36" Tall	AVG2036 Encl GP3232 Base	Green 36" Tall
			AVG2041 Encl GP3232 Base	Blue 41" Tall	AVG2041 Encl GP3232 Base	Pantone 41" Tall	AVG2041 Encl GP3232 Base	Green 41" Tall
		Safety-Guard/Hydro Guard	15100 Encl	Blue 34" Tall	15100 Encl	Pantone 34" Tall	15100 Encl	Green 34" Tall
	Air Release Valves	**Air Release Valves shall be Combination Type, 316 SS**						
		ARI	D-040SS	Combination	D-040SS	Combination	D-020 (SS)	Combination
		H-TEC	NA	NA	NA	NA	986 (316SS)	Combination
		Vent-O-Mat	Series RBX DN50	2"	Series RBX DN50	2"	RGX series	
	ARV Vault	**Air Release Valve Frame and Cover**						
		US Foundry	NA	NA	NA	NA	USF 7665-HH-HJ	
Blow Off	Auto Blow Off	**Automatic Blow Off Valve**						
		Hydro Guard	HG-1 Standard Unit	Automatic	NA	NA	NA	NA
	Blow Off Valve	**Blow Off Valve - Fits standard 5-1/4 inch Valve Box**						
		Kupferle Foundry Co	Truflo Series TF #550		Truflo Series TF #550		NA	NA
		Water Plus Corp	The Hydrant Plus Series VB 2000B		The Hydrant Plus Series VB 2000B		NA	NA
Casing Seals / Spacers	Casing End Seals	**Casing End Seals. Annular space between pipe and steel casing shall be brick and mortar with end seals to secure ends.**						
		Advance Products	Model AC and AW		Model AC and AW		Model AC and AW	
		BWM Company	Model WR and PO		Model WR and PO		Model WR and PO	
		Cascade Water Works	Model CCES		Model CCES		Model CCES	
		CCI Pipeline	Model ESW and ESC		Model ESW and ESC		Model ESW and ESC	
		Pipeline Seal & Insulator, Inc (PSI)	Model C and W		Model C and W		Model C and W	
		Power Seal	Model 4810ES		Model 4810ES		Model 4810ES	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Casing Seals / Spacers	Casing spacer	**Casing spacers shall be a min. 8-inches wide for pipe 12" Dia or less or min. 12-inches wide for pipe 16 or greater , shall have a minimum 14 gauge 304 stainless steel shell/band, minimum 10 gauge 304 reinforced risers; minimum thickness of 0.090 EPDM or PVC interior liners, glass reinforces polymer or ultra high molecular weight polyethylene and 304 stainless bolts, nuts and washers.**						
		Advance Products	SSI8 / SSI12		SSI8 / SSI12		SSI8 / SSI12	
		BWM Company	BWM-SS-8 / SS-12		BWM-SS-8 / SS-12		BWM-SS-8 / SS-12	
		Cascade Water Works	Series CCS 8" / 12"		Series CCS 8" / 12"		Series CCS 8" / 12"	
		CCI Pipeline	Model CCS8 / CSS12		Model CCS8 / CSS12		Model CCS8 / CSS12	
		Pipeline Seal & Insulator, Inc (PSI)	Series S8G-2 / S12G-2		Series S8G-2 / S12G-2		Series S8G-2 / S12G-2	
Coatings	Exterior Coatings for Exposed Metal Assets	**Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 1 Zinc / Urethane / Fluoropolymer application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.**						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
			Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils
	Exterior Coatings for Exposed Metal Assets	**Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 2 Zinc / Epoxy / Urethane application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.**						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils	Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils	Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
		PPG / Ameron	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils
			Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils
			Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Fittings	Fittings	**Ductile Iron Fittings C153 SSB / C110 FLG: (Water & Reclaimed Water fittings shall cement lined or holiday free fusion bonded epoxy lined) (Wastewater fittings interior shall be Protecto 401 and holiday free)**						
		American	30" & up	FBE / Cement	30" & up	FBE / Cement	30" & up	Protecto 401
		Sigma		FBE / Cement		FBE / Cement		Protecto 401
		Star		FBE / Cement		FBE / Cement		Protecto 401
		Tyler Union & Clow		FBE / Cement		FBE / Cement		Protecto 401
Flow	Flow Meter	**Flow Meters With Replaceable Sensors**						
		EMCO	NA	NA	NA	NA	Unimag 4411E	
Hydrants	Hydrants	**Hydrants Shall open left, 1-1/2 Pentagon operating nut, NST hose & pumper thread, rotate 360 degrees, closed drains, epoxy on shoe in & out and 304 SS nuts & bolts below ground.**						
		American Flow Control	B-84-B (6 inch)		NA	NA	NA	NA
		Clow	Medallion 2545		NA	NA	NA	NA
		Mueller	Super Centurion 250		NA	NA	NA	NA
Joint Restraints	Ductile iron pipe MJ Restraints	**Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain ductile iron pipe to mechanical joint fittings, pipe and appurtenances.**						
		EBAA Iron Inc	Megalug Series 1100		Megalug Series 1100		Megalug Series 1100	
		Ford / Uni-Flange	UFR-1400		UFR-1400		UFR-1400	
		Sigma	OneLok Series SLD/SLDE		OneLok Series SLD/SLDE		OneLok Series SLD/SLDE	
		Smith Blair	Cam Lok Series 111		Cam Lok Series 111		Cam Lok Series 111	
		Star	Star Grip Series 3000		Star Grip Series 3000		Star Grip Series 3000	
		Tyler Union	TufGrip Series TLD		TufGrip Series TLD		TufGrip Series TLD	
	DIP Bell Joint Restraints (4"-12") (New & Existing)	**Bell Joint Restraints for Ductile Iron Pipe (4"-12") (New & Existing) - All restraints split serrated on bell and spigot ends. Pipe 16" and greater shall have restraint gaskets or locking bells. (Wastewater only for restraint of existing DIP FM)**						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390C		Uni-Flange Series 1390C		Uni-Flange Series 1390C	
		Sigma	PV-Lok Series PWP-C		PV-Lok Series PWP-C		PV-Lok Series PWP-C	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	StarGrip Series 3100S		StarGrip Series 3100S		StarGrip Series 3100S	
		Tyler Union	TufGrip-Series 300C		TufGrip-Series 300C		TufGrip-Series 300C	
	DIP Bell Joint Restraints (16" & Greater)	**Ductile Iron Pipe Bell Joint Restraints for Ductile Iron Pipe (16" & Greater) - All restraints shall have a split back-up ring for the bell and a serrated or wedge action gland for the spigot end. New installation for water & reclaimed water piping 16" and greater shall have restraint gaskets or locking bells.**						
		EBAA Iron Inc	Series 1100HD	Existing Only	Series 1100HD	Existing Only	Series 1100HD	Existing Only
		Sigma	Series SSLDH	Existing Only	Series SSLDH	Existing Only	Series SSLDH	Existing Only
		Star	Series 3100S	Existing Only	Series 3100S	Existing Only	Series 3100S	Existing Only

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Joint Restraints	Ductile iron pipe Bell Joint Restraint Gaskets and Locking Bell (4" & Above)	**Bell Joint Restraint Gaskets and Locking Bell (4" & Above) Stainless Steel locking wedges built into the gasket-rubber. ANSI/AWWA C111/A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe. Ductile Iron Bell Joint Restraint for Push-On Pipe- Locking bell joint system that prevents joint separation and allows for joint deflection. Bells shall be painted red to verify restrained gasket.**						
		American	Fast Grip Gasket	Gasket	Fast Grip Gasket	Gasket	NA	NA
			Flex-Ring Joint	Bell Lock	Flex-Ring Joint	Bell Lock	NA	NA
			Lok-Ring Joint	Bell Lock	Lok-Ring Joint	Bell Lock	NA	NA
		Griffin	Talon RJ Gasket	Gasket	Talon RJ Gasket	Gasket	NA	NA
			Snap-Lok	Bell Lock	Snap-Lok	Bell Lock	NA	NA
		McWane Inc. DI Pipe Group	Sure Stop 350 Gasket	Gasket	Sure Stop 350 Gasket	Gasket	NA	NA
			Thrust-Lock	Bell Lock	Thrust-Lock	Bell Lock	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			Super-Lock	Bell Lock	Super-Lock	Bell Lock	NA	NA
		US Pipe	Field Lok 350 Gasket	Gasket	Field Lok 350 Gasket	Gasket	NA	NA
			Field Lok Gasket	Gasket	Field Lok Gasket	Gasket	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			HP Lok Restraint Joint	Bell Lock	HP Lok Restraint Joint	Bell Lock	NA	NA
	SS to DIP Transition Restraint	**SS to DIP Transition Restraint -Flanged stainless steel pipe from Wetwell to Valve box restrained joint transition (epoxy coated, SS hardware) Flg x PE RJ.**						
		EBAA Iron Inc	NA	NA	NA	NA	Megaflange 2100	
		Sigma	NA	NA	NA	NA	SigmaFlange with One Lock SLDE	
		Smith Blair	NA	NA	NA	NA	911 Flange - Lock Restrained FCA	
	PVC Pipe MJ Restraints	**Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain PVC pipe to mechanical joint fittings, and appurtenances.**						
		EBAA Iron Inc	Mega-lug Series 2000PV		Mega-lug Series 2000PV		Mega-lug Series 2000PV	
			NA	NA	NA	NA	Megalug Series 2200	(42"-48")
		Ford / Uni-Flange	UFR 1500 Series		UFR 1500 Series		UFR 1500 Series	
		Sigma	One Lok Series SLC/SLCE		One Lok Series SLC/SLCE		One Lok Series SLC/SLCE	
		Smith Blair	Cam Lok Series 120		Cam Lok Series 120		Cam Lok Series 120	
		Star	Star Grip Series 4000		Star Grip Series 4000		Star Grip Series 4000	
		Tyler Union	TufGrip Series TLP		TufGrip Series TLP		TufGrip Series TLP	
	PVC Bell Joint Restraints (4" - 12") (New & Existing)	**PVC Bell Joint Restraints: PVC pipe Split Serrated on Bell End and Spigot End. (4" - 12") (New & Existing)**						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390		Uni-Flange Series 1390		Uni-Flange Series 1390	
		Sigma	PV-Lok Series PWP		PV-Lok Series PWP		PV-Lok Series PWP	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	Series 1100C		Series 1100C		Series 1100C	
		Tyler Union	TufGrip 300C		TufGrip 300C		TufGrip 300C	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Joint Restraints	PVC Bell Joint Restraints (16" & Greater)	**PVC Bell Joint Restraints: (16" & Greater) PVC pipe Split Serrated on Bell End and Spigot End. Water & Reclaimed Water Existing pipe only. Wastewater shall be new and existing pipe.**						
		Ford / Uni-Flange	Series 1390	Existing Only	Series 1390	Existing Only	Series 1390	
		JCM	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	
		Sigma	PV-Lok PWP	Existing Only	PV-Lok PWP	Existing Only	PV-Lok PWP	
		Smith Blair	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	
		Star	Series 1100C	Existing Only	Series 1100C	Existing Only	Series 1100C	
Pipe	PVC C900 DR 18 Bell & Spigot (4" - 12")	**C900 Bell & Spigot PVC Pipe: 4 to 12-inch - AWWA C-900, Minimum DR18 for Water, Reclaimed and Wastewater. DR14 for Fire Lines. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed 4" to 12"	Certa-Lok C900/RJ	Blue	Certa-Lok C900/RJ	Pantone Purple	Certa-Lok C900/RJ	Green
		Diamond Plastics Corp	C-900	Blue	C-900	Pantone Purple	Diamond C900	Green
		Ipex Inc	C-900 Blue Brute	Blue	C-900	Pantone Purple	C900 Blue Brute	Green
		JM Eagle	C-900	Blue	C-900	Pantone Purple	C-900	Green
		National Pipe & Plastics Inc	C-900 Dura- Blue	Blue	C-900	Pantone Purple	C-900 Pipe	Green
		North American Pipe Corp (NAPCO)	C-900	Blue	C-900	Pantone Purple	C-900	Green
		Sanderson Pipe Corp	C-900	Blue	C-900	Pantone Purple	C-900	Green
	PVC C905 DR 18 Bell & Spigot 16" and Larger	**C905 Bell & Spigot PVC Pipe 16" and Larger: AWWA C-905, Minimum DR18 for all Force Mains up to 24". Minimum DR21/DR25 for 30" and greater. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed 16"	NA	NA	NA	NA	Certa-Lok C905/RJ	NA
		Diamond Plastics Corp	NA	NA	NA	NA	Trans-21 DR18	Green
		Ipex Inc	NA	NA	NA	NA	IPEX Centurion	Green
		JM Eagle	NA	NA	NA	NA	C905 Big Blue	Green
		National Pipe & Plastics Inc	NA	NA	NA	NA	C905	Green
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	C905 Big Blue	Green
	HDPE C906 DR11	**HDPE Pipe DR11 AWWA C906 shall be Ductile Iron Pipe Size, PE 3408/3608/4710 DIPS manufactured in accordance with ASTM F-714 and listed with NSF. Pipe shall be marked in accordance with either AWWA C901,AWWA C906. Compression type connections are not acceptable in new installations. Pipe joints shall be butt fusion or electro-fusion with flange or adapter. All HDPE shall be color coded to the Utility. Color identifications are in accordance with the APWA/ULCC Uniform Color Code. Manufacturers shall be members in good standing with PPI to maintain approval status.**						
		JM Eagle	HDPE	DR11 Blue	HDPE	DR11 Pantone	HDPE	DR11Green
		Performance Pipe(Chevron)	Driscoplex 4000	DR11 Blue	Driscoplex 4000	DR11 Pantone	Driscoplex 4300	DR11 Green
		PolyPipe, Inc.	EHMW Poly Pipe	DR11 Blue	EHMW	DR11 Pantone	EHMW	DR11Green

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pipe	Ductile Iron Pipe	**Ductile iron/Cast iron: (4" to 12" = Class 350, 16" to 24" - Class 250, 30" to 64" = Class 200). Water and Reclaimed water shall be cement lined. Wastewater Piping shall be Protecto 401 and Holiday Free. Exterior coatings as specified. Wastewater DIP piping shall be for pump station piping only. Manufacturers shall be members in good standing with DIPRA to maintain approval status.**						
		American	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		Griffin	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		McWane Inc. DI Pipe Group	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		US Pipe	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
Sample	Sample Station	**Sample Stations - Bacteriological Sample Station with built in flush system, all internal piping to be 2", brass and includes lockable green enclosures.**						
		Safety-Guard	SG-BSS-05 pedestal #77	green enclosure	NA	NA	NA	NA
		Water Plus Corp	Model 5000	green	NA	NA	NA	NA
Services	Brass Service Saddles	**Brass Service Saddles for 1" & 2" water & reclaimed water services on 4" through 12" Mains - Service saddles can be hinge or bolt controlled OD saddles to be used on C-900 and existing IPS OD PVC pipe.**						
		Ford	Series S-70, S-90	4"-12"	Series S-70, S-90	4"-12"	NA	NA
		AY McDonald	Model 3891 / 3895,3801 / 3805	4"-12"	Model 3891 / 3895,3801 / 3805	4"-12"	NA	NA
		Mueller	Series S-13000/H-13000	4"-12"	Series S-13000/H-13000	4"-12"	NA	NA
	Service Saddles	**Service Saddles for 1" (CC) & 2" (Iron pipe threads) Water & Reclaimed Water services on mains greater than 12". Service saddles for 2" taps (iron pipe threads) on 4" mains and greater for Waste Water. : Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on C-900 / C905 or DI for all 1-in and -2in taps on pipes over 12in.**						
		Ford	Series FC202	16" & greater	Series FC202	16" & greater	Series FC202	4" & greater
		JCM	Series 406	16" & greater	Series 406	16" & greater	Series 406	4" & greater
		Mueller	DR2S	16" & greater	DR2S	16" & greater	DR2S	4" & greater
		Romac	Series 202NS	16" & greater	Series 202NS	16" & greater	Series 202NS	4" & greater
		Smith Blair	Series 317	16" & greater	Series 317	16" & greater	Series 317	4" & greater
	Service Saddles for HDPE	**Service Saddles for 1" (CC) & 2" (Iron Pipe threads) Water and Reclaimed Water Services: Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on HDPE for all 1-in and -2in taps. Taps to HDPE pipe shall be approved on a case by case basis.**						
		Ford	Series FCP202		Series FCP202		Series FCP202	
		Romac	Series 202N-H		Series 202N-H		Series 202N-H	
		Smith Blair	Series 317-1 for HDPE		Series 317-1 for HDPE		Series 317-1 for HDPE	
	Corporation Stops Ball Type	**Corporation Stops Ball Type (1-inch with AWWA taper C threads only/pack joint outlet for CTS) 2" Corporation Stop Ball Type shall be 2" MIP X FIP threads.**						
		Ford	FB1000, FB1700-7		FB1000, FB1700-7		FB1700-7	2" ARV
		AY McDonald	4701B-22, 3149B2		4701B-22, 3149B2		3149B2	2" ARV
		Mueller	P25008, B-20046		P25008, B-20046		B-20046	2" ARV

APPENDIX D **LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Services	Curb Stops	**Curb Stops - Straight Valves: Ball type compression 2" cts O.D. tubing by 2" FIP**						
		Ford	B41-777W		B41-777W		NA	NA
		AY McDonald	6102W-22		6102W-22		NA	NA
		Mueller	P25172		P25172		NA	NA
	Curb Stops	**Curb Stops - Straight Valves: ball type compression x compression**						
		Ford	B44-444W		B44-444W		NA	NA
		AY McDonald	6100W-22		6100W-22		NA	NA
		Mueller	P25146		P25146		NA	NA
	PE tubing	**Polyethylene tubing: AWWA C901. UV protection (SDR-9) 1-inch and 2-inch only. PE 3408 / PE 4710**						
		Charter Plastics	Blue Ice		Lav Ice		NA	NA
		Endot	Endopure Blue		Endocore Lavender		NA	NA
		JM Eagle	Pure-Core		NA	NA	NA	NA
Tapping Sleeves and Valves	Line Stops	**Line Stops**						
		JCM						
		Romac						
		Smith Blair						
	Tapping Sleeves	**Tapping Sleeves: (Mechanical joint for taps on cast iron, ductile iron, PVC & AC pipe, including size on size) with stainless steel nuts and bolts.**						
		American Flow Control	Series 2800		Series 2800		Series 2800	
			Series 1004		Series 1004		Series 1004	
		Clow	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC
			Series F-5207	A/C Pipe	Series F-5207	A/C Pipe	Series F-5207	A/C Pipe
		JCM	Series 414	FBE	Series 414	FBE	Series 414	FBE
		Mueller	Series H-615	DIP/PVC	Series H-615	DIP/PVC	Series H-615	DIP/PVC
			Series H-619	A/C Pipe	Series H-619	A/C Pipe	Series H-619	A/C Pipe
		Smith Blair	Style 623	FBE	Style 623	FBE	Style 623	FBE
	Tapping Valves: 12" and smaller	**Tapping Valves: 12" and smaller - Tapping Valves shall be furnished with an alignment lip and installed in the vertical position for Water and Reclaim Water. Wastewater shall be installed horizontally and abandoned in the open position. Tapping valves shall be resilient seated only and meet the requirements of AWWA C509 or C515**						
		American Flow Control	Series 2500	Alignment Lip	Series 2500	Alignment Lip	Series 2500	Alignment Lip
		Clow	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip
		Mueller	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Tapping Sleeves and Valves	Tapping Valves: 16" and Larger	**Tapping Valves: 16" and Larger - Tapping valves shall be furnished with an alignment lip and be installed in the vertical position for Water and Reclaimed Water. No tapping valve shall be installed horizontally for Water and Reclaim Water unless approved by the engineer. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. All tapping valves above 24" shall be furnished with NPT pipe plugs for flushing the tracks when valves are installed horizontally. Tapping valves for Wastewater shall be installed horizontally and abandoned in open position.**						
		American Flow Control	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port
		Clow	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port
		Mueller	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port
Valves	Butterfly Valve 42" and Above	**Butterfly Valves 42"and above. AWWA C504. Actuators input torques based on 150 psi valve pressure and 16 fps velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. Valve seats shall be leak-tight in both directions at 150 psi.**						
		Clow	Style #1450		Style #1450		NA	NA
		Dezurik	BAW		BAW		NA	NA
		Mueller / Pratt	LINSEAL III / Groundhog		LINSEAL III / Groundhog		NA	NA
	Check Valves	**Valves (Check) 4-inch and Larger (8 mil epoxy lined)**						
		American Flow Control	NA		NA		Series 600 or 50 line	
		Clow / M&H / Kennedy	NA		NA		106	
		Mueller	NA		NA		Series 2600	
	Gate Valves 4" - 12"	**Gate Valves 12" and smaller - resilient seated only AWWA C509 or C515. Valve seat shall be leak-tight in both directions at 150 psi.**						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100		NA	NA
		Mueller	Series A-2360		Series A-2360		NA	NA
	Gate Valves (Vertical) 16" and Up	**Gate Valves 16" and larger (Vertical Installation) AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a gear actuator unless noted by the engineer. Valve seat shall be leak-tight in both directions at 150 psi.**						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100			
		Mueller	Series A-2361		Series A-2361		NA	NA

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Valves	Plug Valves	**Plug Valves - Bi-directional, MJ & Flanged (min. 8mil fusion bonded epoxy with stainless steel bolts), gear operator to be sized for rated pressure of the valve. Valves 4"-20" shall be 80% Full Port and valves 24" and greater shall be minimum of 70% full port. Valve shall be factory tested to minimium 100 PSI in both directions.**						
		Clow	NA	NA	NA	NA	F-5412 FLG	4" & up
			NA	NA	NA	NA	F-5413 MJ	4" & up
		Dezurik	NA	NA	NA	NA	Series PEF or PEC	4"& up
		Millikan / Pratt	NA	NA	NA	NA	Eccentric / Ballcentric	4"& up
		Val-Matic	NA	NA	NA	NA	5600 or 5800 (FLG)	4" & up
			NA	NA	NA	NA	5700 or 5900 (MJ)	4" & up
Valve Boxes	Valve Boxes with Locking Lids (Cast Iron)	**Two piece standard screw type Heavy Duty Valve Boxes with Locking Lids (Cast Iron) and type of service cast in heavy duty traffic lid (H20 loading) ASTM A48**						
		Bingham/Taylor	Series 4905	Box	NA	NA	Series 4905	Box
			4905-X	Extension	NA	NA	4905-X	Extension
			4904-L	Blue Water Locking Lid	NA	NA	4904-L	Green Sewer locking Lid
		Sigma	Series VB 261X-267X	Box	VB-25031LK-VB-2612	Box	Series VB 261X-267X	Box
			VB 6302	Extension	VB-6302	Extension	VB 6302	Extension
			VB 4650W	Blue Water Locking Lid	VB2503LK	Purple Square Locking Lid	VB 4650S	Green Sewer locking Lid
		Star	Series VB-0002	Box	NA	NA	Series VB-0002	Box
			VBEX 12-24S	Extension	NA	NA	VBEX 12-24S	Extension
			VBLIDLOCK	Blue Water Locking Lid	NA	NA	VBLIDLOCK	Green Sewer locking Lid
		Tyler Union	Series 6850	Box	NA	NA	Series 6850	Box
			58, 59, 60	Extension	NA	NA	58, 59, 60	Extension
			Locking Lid	Blue Water Locking Lid	NA	NA	Locking Lid	Green Sewer locking Lid
	Valve Box	**For mains equal to, or greater than, 16" diameter or equal to greater than 6' feet deep**						
		American Flow Control	# 2A - 9A Retrofit Valve Box Insert	Fit inside std valve boxes	NA		2A - 9A Retrofit Valve Box Insert	Green Sewer locking Lid
		Mueller Company	MVB050C thru MVB130C with Extension Stem MVB875 Guide Plate	Blue Water Locking Lid	MVB050CR thru MVB130CR with Extension Stem MVB875 Guide Plate	Purple Square Locking Reclaim Lid	MVB050C thru MVB130C with Extension Stem MVB875 Guide Plate	Green Sewer locking Lid

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Coatings	Anti-Graffiti Paint	**Block Walls-Anti-Graffiti Paint per Section 3119 Coatings & Linings**						
		American Building Restoration Products	NA	NA	NA	NA	Polyshield Graffiti Preventer for Unpainted Masonry Type B	Super Bio Strip or Strip it all
		Tnemec / Chemprobe	NA	NA	NA	NA	626 DUR A PEL	680 Mark A Way
		Professional Products of Kansas, Inc	NA	NA	NA	NA	Professional Water Seal & Anti-Graffitiant (PWS-15 Super Strength)	Professional Phase II Cleaner
	Coatings for Existing Manholes	**Rehabilitation corrosion protection system per Section 3119 Coatings & Linings. Interior coating for force main connections to existing concrete manholes only. New precast structures and existing pump stations shall be lined.**						
		CCI Spectrum, Inc	NA	NA	NA	NA	Spectrashield	min of 500 mils
		Kerneos Aluminate Technologies	NA	NA	NA	NA	Sewpercoat	1" (1000mil)
		Raven Lining System	NA	NA	NA	NA	Raven 155 Primer Raven 405	min 8 mils min 125 mils
		Sauereisen	NA	NA	NA	NA	210 Series Topcoat Glaze 210G	min 125 mils min 20 mils
		Tnemec	NA	NA	NA	NA	Series 434 Topcoat Glaze 435	min 125 mils 15-20 mils
PVC Pipe and fittings	Pipe SDR 35 Gravity Mains	**PVC Pipe for Gravity SDR26/SDR 35 (Green in color) ASTM-D034. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed	NA	NA	NA	NA	Gravity Sewer Pipe	
		Diamond Plastics Corp	NA	NA	NA	NA	Sani-21 SDR-35	
		JM Eagle	NA	NA	NA	NA	Gravity Sewer	
		National Pipe & Plastics, Inc.	NA	NA	NA	NA	Ever-Green Sewer Pipe	
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	Gravity Sewer	
		Sanderson Pipe Corp	NA	NA	NA	NA	Gravity Sewer	
	Locate Balls	**Locating Marker Systems - Wastewater Locator balls placed at all sanitary sewer cleanouts**						
		3M	NA	NA	NA	NA	3M™ EMS 4" Extended Range 5' Ball Marker 1404-XR	
	Fittings SDR 35	**Fittings, Adapters and Plugs - Gravity PVC ASTM-D3034, Min SDR26/ SDR 35**						
		GPK Products, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Harrington Corporation (HARCO)	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Multi Fittings Corp.	NA	NA	NA	NA	SDR26/SDR 35 Trench Tough Sewer Fittings	
		JM Eagle	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Plastic Trends Inc	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		TIGRE USA, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
PVC Pipe a	Flexible Pipe Connectors	**Flexible Pipe Connectors and Transitions**						
		Fernco	NA	NA	NA	NA	1002, 1051, 1056 Series	
		Indiana Seal	NA	NA	NA	NA	102, 151, 156 Series	
		Mission Rubber	NA	NA	NA	NA	MR02, MR51, MR 56 Series	
Precast Concrete Structures	MH Lids	**Frame and Cover**						
		USF Fabrication Inc.	NA	NA	NA	NA	USF 225-AS	
	Adj Ring	**Top Adjusting Rings - HDPE with heavy duty loading (H-20)**						
		Ladtech, Inc	NA	NA	NA	NA	24R, 24S with Rope Sealant CS2455	
	Hatches	**Wet Well and Valve Vault Access Frames and Covers (Include the term "Confined Space" etched or cast into the cover with recessed lock & hasp. Frames and covers per manufacturers specifications.**						
		Halliday Products	NA	NA	NA	NA	S1R or S2R Series	
		USF Fabrication Inc.	NA	NA	NA	NA	APS or APD Series	
	Precast Concrete Structures	**Precast Manhole and Wetwell Structures ASTM C478. Precast concrete shall be batched with concrete dyed crystalline waterproofing admixture with corrosion protection. Concrete without admixture or without color tint /tracer shall be rejected.**						
		Allied Precast	NA	NA	NA	NA	Dyed Admix	
		Atlantic Concrete Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Delzotto Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Dura Stress Underground Inc.	NA	NA	NA	NA	Dyed Admix	
		Hanson Pipe & Product	NA	NA	NA	NA	Dyed Admix	
		Mack Concrete	NA	NA	NA	NA	Dyed Admix	
		Oldcastle Precast	NA	NA	NA	NA	Dyed Admix	
		Standard Precast Inc.	NA	NA	NA	NA	Dyed Admix	
	Concrete Admix	**Crystalline Waterproofing Concrete Admix with color dye shall be added to all concrete structures (precast and cast-in-place) to provide waterproofing and corrosion resistance. Concrete without admixture or without color tint / tracer shall be rejected. % concentration of admix with colored dye added to the mix shall be based on weight of cement.**						
		Kryton International	NA	NA	NA	NA	KIM K-301R (with red dye)	2%
		Xypex Chemical Corp	NA	NA	NA	NA	Xypex Admix C-1000Red (with red dye)	3.0 - 3.5%
	Liners	**Interior Liner for New or existing Precast Manhole and Precast Wetwell Structures per Section 3119 Coatings & Linings**						
		AFE	NA	NA	NA	NA	Fiberglass Liner	
		AGRU Liner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)	
		Containment Solutions Inc. (Flowtite)	NA	NA	NA	NA	Fiberglass Liner	
		GSE Studliner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)	
		GU Liner	NA	NA	NA	NA	Reinforced Plastic Liner	
		L & F Manufacturing	NA	NA	NA	NA	Fiberglass Liner	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Precast Concrete Structures	Heat Shrink Seal	**Heat Shrink Seal - Precast structures shall be primed with manufacturer approved primer prior to application of heat shrunk encapsulation.**						
		Canusa-CPS	NA	NA	NA	NA	Wrapid Seal with WrapidSeal Primer (Canusa G Primer)	
		Pipeline Seal & Insulator, Inc (PSI)	NA	NA	NA	NA	Riser Wrap with Polyken 1027 or 1039 primer	
	Jointing Material	**Jointing Material Min. 2" width for all products to ensure squeeze out with manufacturer approved primer.**						
		Henry Company	NA	NA	NA	NA	Ram-Nek	with Primer
		Martin Asphalt Company	NA	NA	NA	NA	Evergrip 990	with Primer
		Trelleborg Pipe Seals	NA	NA	NA	NA	NPC – Bidco C-56	with Primer
	Pipe Seals Gravity	**Resilient Connector Pipe Seals, Manhole - Gravity less than 12-inch and less than 15-ft deep**						
		Atlantic Concrete	NA	NA	NA	NA	A-Lok (cast-in-place)	
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal (cast-in-place)	
		IPS	NA	NA	NA	NA	Wedge Style	
		NPC	NA	NA	NA	NA	Kor-N-Seal Model WS	
		Press seal gasket	NA	NA	NA	NA	PSX Direct Drive	
	Pipe Seals Gravity	**Cast in Place Pipe Seals, Manhole - Gravity Greater Than or Equal to 12-inch and all pipe sizes greater than 15-ft deep**						
		Atlantic Concrete	NA	NA	NA	NA	A-Lok	cast in place
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal	cast in place
	FM Pipe Seals	**Modular Pipe Seals for Wet Well and Valve Box penetrations and all forcemain connections to existing and new precast concrete structures. EPDM Rubber with 316 SS Hardware**						
		CCI Pipeline Systems	NA	NA	NA	NA	Wrap-It Link WL-SS Series	
		Pipeline Seal & Insulator, Inc / Link Seal	NA	NA	NA	NA	Link-Seal S-316 Modular Seal	
		Proco Products, Inc	NA	NA	NA	NA	PenSeal ES-PS Series	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Generator	Gen	**Generator Systems, Fixed Shall be UL 2200 Certified.**						
		Caterpillar	NA	NA	NA	NA	CAT Diesel Generator Set	
		Cummins Power Generation	NA	NA	NA	NA	Diesel Generator Set	
	Fuel Tanks	**Generator Fuel Tanks. Shall be UL2085 certified.**						
		Convault	NA	NA	NA	NA	CVT-3SF or CVT-3FF	
		Phoenix	NA	NA	NA	NA	Envirovault	
	GR	**Generator Receptacle (GR)**						
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042 (230V, 200A, 3P, 4W)	With AJA1 Angle Adaptor
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042-S22 (460V, 200A, 3P, 4W)	With AJA1 Angle Adaptor
		Pyle National	NA	NA	NA	NA	JRE-4100 (230V, 100A, 3P, 4W)	
	ATS	**Generator Transfer Switch**						
		Russelectric	NA	NA	NA	NA	RMTD Series with model 2000 controller	NEMA 12/3R 316SS Enclosure
Odor Control Units	Biotrickling Filters	**Biotrickling filters**						
		BioAir	NA	NA	NA	NA		
		Biorem	NA	NA	NA	NA	Biosorbens BTF	
		Envirogen	NA	NA	NA	NA	BTF	
		Siemens	NA	NA	NA	NA	Zabocs BTF	
	Carbon Adsorption Units	**Carbon Adsorption Units**						
		Calgon	NA	NA	NA	NA		
		Pure Air Filtration	NA	NA	NA	NA		
		Siemens	NA	NA	NA	NA		
Pressure Gauges	Pressure Gauges	**Pressure Gauges shall have Diaphragm Seals. Oil filled.**						
		Ashcroft	NA	NA	NA	NA	10 1008SL 02L 60# 25 200SS 02T XYTSE	Gauge Diaphragm Seal
		Trerice	NA	NA	NA	NA	D83LFSS4002LA100 - Gauge M51001SSSS - Diaphragm Seal D99100 Fill and Mount Charge	
		Winter Gauges	NA	NA	NA	NA	PFQ770 0-60 PSI D70950 top D70954 Bottom	
Pumps	Pumps	**Submersible Pumps**						
		ABS	NA	NA	NA	NA		
		Flygt	NA	NA	NA	NA		

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pumps	Floats	**Float Regulator (FR) - Duplex and Triplex Pump Stations**						
		Atlantic Scientific	NA	NA	NA	NA		Roto-Float
	Radar	**Radar - Pulse Burst Radar Transmitter. Input 24 VDC and Output 4-20 mA**						
		Magnetrol	NA	NA	NA	NA		R82-520A-011
Pump Station Main Ser	Main Srvc Disconne	**Main Service Disconnect Breaker**						
		Square D	NA	NA	NA	NA		H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)
	Surge Protector Device	**Surge Protector - UL 1449, 3rd Edition listed and labeled, minimum 10 year warranty, NEMA LS-1 and IEEEC62, 41/45 tested with NEMA 4X enclosure, internal fusing, voltage and phase to match service. Rated 80,000 amps per mode for Duplex & Triplex stations and 150,000 Amperes per mode for Master Stations. All devices shall be provided with a NEMA 4X Plastic enclosure which is approved in lieu of stainless steel.**						
		Current Technology (Power & Systems	NA	NA	NA	NA		XN-80, TG-150 or CurrentGuard 150 Plus Series
		Josyln AKA (Total Protection Solutions)	NA	NA	NA	NA		TSS-ST 160 Series, ST 300 Series or JSP-300 Series
		Surge Suppressors, Inc	NA	NA	NA	NA		LSE Series or SHL Series
Sub Panel	Sub Panel	**Sub-Panel Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop**						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
Pump Station Control Panel	Control Panel	**Control Panel Supplier**						
		ECS	NA	NA	NA	NA		
		Sta-Con Inc	NA	NA	NA	NA		
	Enclosure	**Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop**						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
	Mnts	**Mounting Channel for Enclosures**						
		Unistrut Stainless Steel	NA	NA	NA	NA		1" 5/8 x 1" 5/8 316 SS
	Seal-off	**Explosion-Proof Sealoff**						
		Cooper Crouse-Hinds	NA	NA	NA	NA		EYSR - 2 Inch Min.
	FL	**Flasher (FL)**						
		MPE	NA	NA	NA	NA		025-120-105
		SSAC	NA	NA	NA	NA		FS-126

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	AL	**Alarm Light / With Base and Globe (AL)**						
		American Electric	NA	NA	NA	NA	F32552	
		Red Dot Globe	NA	NA	NA	NA	VGLR-01	
		Red Dot Base					VA-01	
	AH	**Alarm Horn (AH)**						
		Wheelock	NA	NA	NA	NA	3IT-115-R	
	Fuse	**Fuses (F)**						
		Bussmann	NA	NA	NA	NA	FNQ-R or KTK-R	
	HOA	**Hand-Auto-Off Selector (HOA)**						
		Square D	NA	NA	NA	NA	9001-SKS43B	
	HSS	**Horn Silence Button (HSS)**						
		Square D	NA	NA	NA	NA	9001-SKR1RH5	
	Inter-lock	**Mechanical Interlock**						
		Square D	NA	NA	NA	NA	S29354	
	Breakers	**Control Panel Main Circuit Breaker (MCB) With S29450 Circuit Breaker Auxiliary Switch**						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Emergency Circuit Breaker (ECB) With S29450 Circuit Breaker Auxiliary Switch						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Motor Circuit Breaker (MB)						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Control Circuit Breaker/ GFCI Receptacle Breaker/ SCADA Breaker						
		Square D	NA	NA	NA	NA	QOU120	
	MS	**Motor Starter (MS)**						
		Square D	NA	NA	NA	NA	Type S Class 8536	
	OL	**Overload Heater(OL)**						
		Square D	NA	NA	NA	NA	Part number will vary with size needed	
	OR	**Overload Reset**						
		Square D	NA	NA	NA	NA	9066-RA1	
	Transformer	**Control Circuit Transformer (XMFR)**						
		Square D	NA	NA	NA	NA	9070TF75D23	120/24 Volt .075 KVA
		Main Circuit Transformer (MCT)						
		Square D	NA	NA	NA	NA	9070T2000D1	480/120 2KVA
	SPB	**Supplemental Protector Breaker - 3 pole, 1-amp for Phase Monitor**						
		Square D	NA	NA	NA	NA	MG24532	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	PM	**Phase Monitor (PM)**						
		MPE 240 V.	NA	NA	NA	NA	001-230-118-OVG5	
		MPE 480 V.	NA	NA	NA	NA	002-480-123-OVG5	
	Pump Alternator	**Pump Automatic Alternator (PAA)**						
		Diversified Duplex	NA	NA	NA	NA	ARA-120-ACA	
		Diversified Triplex	NA	NA	NA	NA	ARA-120-AME	
		MPE Duplex	NA	NA	NA	NA	008-120-13SP	
		MPE Triplex	NA	NA	NA	NA	009-120-23P	
		MPE Triplex Socket	NA	NA	NA	NA	SD-12-PC	
	Alt. Test Switch	**Alt. Test Switch**						
		Carling Technologies	NA	NA	NA	NA	6GG5E-78	
		Honeywell	NA	NA	NA	NA	2TL1-50	
	Relay	**Relay**						
		Potter Brumfield 24 Volt	NA	NA	NA	NA	KRPA-11AN-24	
		Potter Brumfield 120 Volt	NA	NA	NA	NA	KRPA-11AN-120	
		Square D 24 Volt	NA	NA	NA	NA	8501KP12P14V14	
		Square D 120Volt	NA	NA	NA	NA	8501KP12P14V20	
	Relay Base	**Relay Base**						
		IEDC 8 Pin Relay Base 600 Volt	NA	NA	NA	NA	SR2P-06	
	Duplex Receptacle / GFCI	**Duplex Receptacle/GFCI (DR) Upgraded to 20 Amp**						
		Hubbell	NA	NA	NA	NA	GFTR20BK	
		Pass & Seymour	NA	NA	NA	NA	2095TRBK	
	ETM	**Elapse Time Meter (ETM)**						
		Reddington	NA	NA	NA	NA	711-0160	
	Grounding	**Grounding System**						
		Marathon	NA	NA	NA	NA	Neutral Isolation Block 1421570	
		Panduit	NA	NA	NA	NA	Ground Lug LAM2A 1/0 - 014 -6Y	
		Square D	NA	NA	NA	NA	Ground Buss PK7GTA	
	TS	**Terminal Strip (TS)**						
		Marathon	NA	NA	NA	NA	Series 200	
		Square D	NA	NA	NA	NA	9080GR6	
	TS	**Terminal Strip End Blocks and End Clamps**						
		Square D	NA	NA	NA	NA	9080GM6B & 9080GH10	

APPENDIX D **LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	PL	**Pilot Light (PL) 24 Volt with 1819 Bulb**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelight 930507X	
	RL	**Run Indicator Light (RL) 120 Volt**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X With 120MB Bulb	
	MT	**Moisture and Temperature Failure Light (MT) 120 Volt with 120MB Bulb**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X	
Sluice	Sluice Gate	**Sluice Gate for Wet Well with Motorized Operator**						
		BNW	NA	NA	NA	NA	Model 77 - 316 SS	
		Fontaine	NA	NA	NA	NA	Model 20 - 316 SS	
VFD	VFD	**Variable Frequency Drives**						
		Square D	NA	NA	NA	NA		

Attachment E
General Access and Security Guidelines

GENERAL ACCESS AND SECURITY GUIDELINES
WATER SUPPLY FACILITIES CHEMICAL SYSTEMS PROJECT

1. SECURITY:

A. The Contractor agrees to adhere to all established security, safety and Emergency Action Plans and policies as required by the Owner.

B. Prior to work at any water facility, the contractor shall perform criminal background checks on all personnel who will be working on the project. The level of background check shall be in accordance with county standards. The results of these background checks shall be supplied to the county project manager prior to the start of work,

C. C, For security reasons, the Contractor must provide the names of it's employees who will be on the site during the normal work day and for all after hours work to the Owneror access will be denied. Once these names and the appropriate background check information has been received the Owner will create an approved list of contractor's personnel.

D. Access to the facility will be granted by calling the main SCADA control desk at 407-254-9509 who will open the facility gate provided the contractor's personnel are on the approved list.

E. The Owner will designate locations for the Contractor to have an equipment lay down area, construction site office trailer and an employee parking area.

F. The Contractor's employee's private vehicles shall be parked in the designated parking area only. Private vehicles parked on the job site other than the designated area will subject to be towed at the vehicles owner's expense.

2. IDENTIFIACTION BADGES:

The Contractor will be responsible to:

A. Supply the Owner with names of all employees including and sub-contractor's employees working on the job site.

B. Ensure that all employees have current photo identification to gain access to the site.

C. The ID list is to be updated any time a change is made by the Contractor or Sub-contractors.

3. FACILITY ACCESS:

Contractor and Sub-Contractor employees:

A. Under normal situations, all employees of the Contractor and Sub-Contractor's must use call the SCADA desk for entry to the plants for approved work. The county inspector should also be on the site to oversee the work. Provided they are on the approved personnel list they will be granted access to the work site for the normal work day. The

gate is to be closed at all times except when taking deliveries or at the start or end of the work day.

Visitors, Vendors and Deliveries:

A. Under normal situations, all, vendors and deliveries must use the main gate for entry and exit of the Facility. The contractor's staff shall be available to accept the delivery and ensure it is properly stowed in the area designated by the owner's on-site inspector.

B. The Contractor will notify SCADA and provide the name and company name of Vendors or Contractor representatives that are not listed on the Access listing and when they have a scheduled visitor.

C. Prior to Facility access, SCADA will contact the Contractor to verify a visitor.

D. Visitors, vendors or deliveries that can not be identified and approved for entry, even persons with a Contractor I.D that is not on the ID list, will not be allowed access to the facility.

E. The Owner's employees will not accept deliveries designated for the Contractor. Contractor will be required to establish a separate project address for deliveries to the site. The Owner will not be responsible for lost or misplaced deliveries.

4. EMERGENCY ACTION PLAN:

A. The Owner has a well-defined and approved Emergency Action Plan for each Facility. The Plan covers known emergencies that may occur on the facility. Including the most hazardous, a chlorine leak or chemical spill. The Owner will provide to the Contractor the most updated Emergency Action Plan.

B. The Owner shall provide to the Contractor and the Contractor's initial employees, a training session for the Emergency Action Plan. The Facility's Safety Officer or the Division Safety Section staff will conduct this training. All Employees given this training will be required to sign the training class roster.

C. After the initial training, the Contractor must provide new employee assigned to the Project this training and provide to the Owner training document for every employee trained by the Contractor.

This document may be revised to ensure th at the Project progresses, to monitor and maintain communications, safety and secu rity per the Contract, Local, State and Federal laws and ordinances.